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Dues for 1932

Annual Dues for 1932 Are Now Payable

This is the Treasurer's first notice to all members that dues for 1932 are now due and payable to the Treasurer

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The Club values the continued support of every member, and every resignation is received with regret. In spite of the depression and a very great loss in membership, we have published a larger volume this year than in any preceding year of the organization—and without a deficit; though, of course, we do not expect our bank balance to be as large as at the close of last year. During 1931 the Club received about one hundred new members and lost about double that number. If there are any members at present who feel inclined to raise their membership status from Associate to Active, or from Active to Sustaining, it will help materially to maintain the number of pages in the BULLETIN for the coming year.

In behalf of the Officers of the Club, the WILSON BULLETIN extends greetings of the season to its readers, and wishes to thank them for their loyalty and generous support.

MAR 31 1932

THE
WILSON BULLETIN

A Quarterly Magazine Devoted to the Study
of Birds in the Field
and the Official Organ of the

WILSON ORNITHOLOGICAL CLUB

Edited by
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Myron H. Swenk Albert F. Ganier
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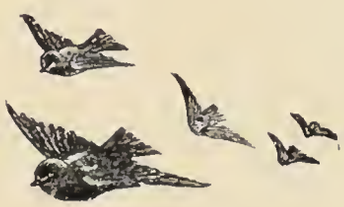

Volume XLIV
1932

Published Quarterly
by the
WILSON ORNITHOLOGICAL CLUB
at
Sioux City, Iowa

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A Magazine of Field Ornithology

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THE WILSON BULLETIN

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Founded December 3, 1888. Named after Alexander Wilson, the first American ornithologist, and called the "Father of American Ornithology."

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The following societies are affiliated organizations:

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The Kentucky Ornithological Society.
The Tennessee Ornithological Society.

THE WILSON BULLETIN

A QUARTERLY MAGAZINE OF ORNITHOLOGY
Published by the Wilson Ornithologieal Club

Vol. XLIV MARCH, 1932 No. 1

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NESTING OF THE BALD EAGLE

BY A. F. GANIER

My first expedition in quest of a nest of the Bald Eagle (*Haliaetus leucocephalus*) dates baek to some thirty years ago. At that time I was living in the lower Mississippi Valley in the little eity of Vicksburg, Mississippi, when word was brought to me of an eagle's nest about twenty miles above town at a lake whieh lay seeluded among the eypress swamps. I at onee began to lay plans and entertain visions of eolleeting the eggs for my fast growing colleetion. Ben, my partner in the egg eollecting game, was a poor elimber himself, but flattered my youthful eonfidenee by pieturing what a mere everyday affair it would be for me to scale the mere hundred feet or so, and then how thrilling it would be to look over the brim at two great white eggs of the King of Birds. The day of days finally arrived, the 5th of April, 1899, to be exact, and we sallied forth well loaded down with elimbing irons, ropes, luneh, camera, and last but not least a box filled with cotton in whieh to pack the eggs. We left the train at an obscure little station and, after inquiring the way to Cypress Lake, we launehed forth on a four-mile trek through an unbroken forest. Our boyish spirits were keyed up to the highest pitch and I never recall a more pleasant tramp, with sunlight breaking through the trees overhead and woodland voiees all about us. As we approaehed the lake, however, our troubles began. We were beginning to tramp through shallow water and before open water was reaehed we were knee deep and all but lost in a jungle of "button willow" bushes. No one lived at the lake and no boat could be found, so we began a tedious tramp, peering overhead meanwhile, trying to loeate the eagle's nest among the tree-tops. To make a long story short, we finally eame upon the eyrie at three o'elock in the afternoon, and to our dismay we saw that it had been built among the topmost braneh es of a giant eypress tree, larger than we had ever dreamed of. The trunk was about eight feet in diameter at shoulder height, and sinee it was approximately sixty feet up to the first limb we decided that after all the eggs weren't worth

the effort and that it was about time to start back to the railway station anyway.

A good many years passed between that first eagle's nest and my second. A good many events crowded into my life other than bird study and, too, I may have been influenced by the impression I had gotten to the effect that an eagle's nest was not a climbable affair after all. And so it happened that it was not until 1919 that I had the pleasure of looking upward into another great cypress tree to view my second nest. The site of this nest was in the low forest which borders Reelfoot Lake, Tennessee, at its upper end. This lake, lying in the extreme northwest corner of the state and close to the Mississippi, was formed by an earthquake in 1812. It is from two to four miles wide and about twelve miles long. Cypress trees, which were submerged when the lake was found, continue to grow where the water is less than three or four feet deep and large areas are grown up in saw-grass. "Black Slough" is a shallow wooded swamp in the low forest, above referred to, and here in a large old cypress was the first of three nests which I succeeded in finding at this lake. At the time of my visit, on May 30, the young had just left the nest. It was constructed almost entirely of dead cypress limbs and twigs and, due to the decay resistant quality of this wood, the nest, though old, was in good condition. The interior lining was composed largely of cypress bark which, like cedar bark, is very fibrous and may be torn from the trees in long and pliable strips. The outer portions of the nest, the limbs below and the ground underneath were much soiled with excreta ejected by the young before they left. This description of a nest is quite applicable to seven others which it has been my good fortune to find.

The next nest located was at the southwest corner of the lake, in a very similar environment and about five miles southwest of Black Slough. It was built near the top of one of the largest cypress trees I have ever seen and which was dead at that time. A conservative estimate of its height would be 125 feet. It reminded me of the nest visited when I was a boy so I made no attempt to scale its dizzy height. My visit here was on May 26, 1921, and as in the previously described nest, the young had already taken flight. I believe that this site had been selected for the reason that within a few hundred feet was a long established nesting colony comprising some two hundred and fifty nests of the Great Blue Heron and fifty nests of the Double-crested Cormorant. The young of these birds doubtless come in quite

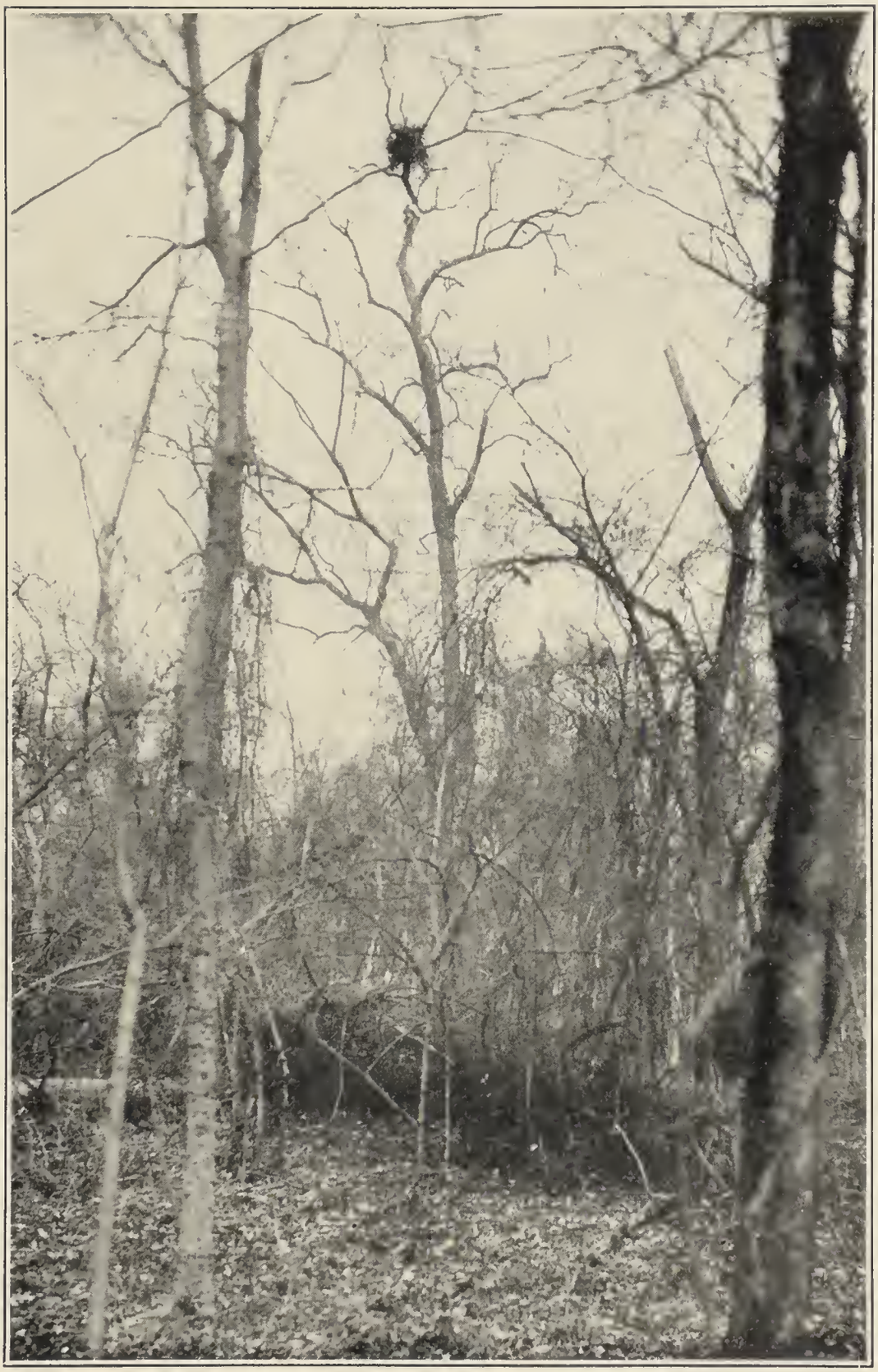
FIG. 1. Nest of the Bald Eagle in the "Scatters," Reelfoot Lake, Tenn.

handy to vary the bill of fare of the young eagles and of course the inhabitants of the rookery can do nothing less than pay tribute.

The third and last nest at Reelfoot, I found well out into the lake, about two miles east of the one last described. It differed from the others in that its location was quite open, being built in a living cypress in a narrow fringe of these trees which form one of "the scatters", projecting far out into the open water. The eyrie was easily visible from a distance and the tree was not a particularly large one. The nest was some sixty feet above the shallow water in which the tree grew. On the date of my visit, May 24, 1923, the one large young bird which the nest held, appeared to be quite capable of taking its first flight and spent most of its time perched on limbs several feet from the nest (Fig. 1). Many irresponsible hunters and fishermen visit this lake, some wishing nothing better than to take a pot shot at an eagle, so it is quite probable that as many young eagles are shot from this nest as leave it on full-fledged wings. I have endeavored, on my several trips to Reelfoot, to do missionary work on behalf of these splendid birds but find it difficult to convince irresponsible people, chiefly visitors, that they should refrain from shooting an eagle.

For some years I had been getting reports of a swamp-surrounded lake some twenty miles southwest of Memphis, Horseshoe Lake by name, where more than one Bald Eagle was said to breed. I had pretty well combed the Tennessee lowlands and had come to the conclusion that nowhere else in this area than at Reelfoot, could a nest of this species still be found. On March 9, 1930, Mr. B. B. Coffey, of Memphis, and myself, with a small group of local bird students, visited Horseshoe Lake and spent the day with interesting results. On arrival, we embarked in a motor boat and after a twenty-minute cruise, had the pleasure of sighting an eagle's nest built near the edge of a low wooded island around which the lake made nearly a complete circle. This island was almost a mile long and was covered with virgin forest, immense white oaks predominating. It is owned by a hunting club which has for some time given protection to the eagles and which has also stocked the place with deer.

As our boat neared the shore, we had the pleasure of seeing a fine white-headed eagle sitting on a branch near the nest and another on the wing nearby. We landed, and as we approached the eyrie both birds circled about within a few hundred yards of us, giving vent to their shrill cries; but after a time they settled on trees some distance away showing no further concern. I supposed that this nest held eggs in



Photograph by B. B. Coffey.

FIG. 2. Climbing to a nest of the Bald Eagle in the Mississippi River Swamp Country. The rim of this eyrie was 103 feet from the ground. The nest held young birds, the eggs having been laid about Christmas time.

course of incubation, because of the fact that March 1st had marked the laying date of a pair in Arkansas, some sixty miles to the north, a few years before. The nest was built about seventy feet from the ground in a large elm (Fig. 4). The tree presented a swollen place in its trunk, some distance above the ground, which made climbing a difficult job, so I postponed the attempt, hoping to find another nest more accessible. After a short search we found a second nest not far away, built in an immense oak, but since no eagles were about we passed it by. Cruising along the shore, flushing flocks of ducks and cormorants here and there, we espied a third nest, also on the island, and drove the boat through the willows to the shore. Wading several shallow sloughs we approached the nest tree and again had the thrill of seeing a fine white-headed eagle leave it, joining its mate in the air. The pair then sailed around above us within a few hundred feet of our heads, voicing disapproval and giving us a wonderful example of how bold these birds will become if afforded protection. I resolved to climb this tree without searching further. The tree was a white oak and the nest, measured later, was 103 feet above the ground. Due to the trunk being clad with rough, loose bark, progress was slow and it required nearly an hour of gruelling work to reach the nest. Resting on a branch a few feet below the big platform (Fig. 2) I surveyed the forest about me. To the west, at a distance of a half mile and at the far end of the island. I was pleasantly surprised to see still another eagle's nest (Fig. 3) and this, when later visited, was found to be occupied. It was built in a large white oak about eighty feet up.

A stiff chilling breeze and swaying branches made the last ten feet of my climb more or less of an adventure, but I finally succeeded in working my head and shoulders through the rim of the nest and looking upon the eyrie. I was totally unprepared for the sight which greeted me for there, standing before me with mouths open and feathers bristling, were two young eagles nearly as large as their parents. They were apparently nearly ready to fly and were as black as vultures. After noting the nest carefully I descended and we visited nests number four and number one. Both of these were found to have two young which, as well as I could judge from the tops of nearby trees, were of about the same age as those more closely examined. By comparison with the pictures taken by Professor F. H. Herrick, I judged them to be about fifty days old. Allowing thirty-five days for incubation it would appear that the eggs of these three pairs were laid prior to Christmas, a date rather surprising for any location north of the latitude of southern Louisiana.

The valley immediately adjacent to the Mississippi River, from Memphis southward, is doubtless the last great stronghold of Bald Eagles in the interior of the United States. The meandering river itself contains many wooded islands and "old rivers", formed by cut-offs, while nearby are numerous extensive cypress swamps and lakes of considerable size, some of which are bordered by low woodlands and uninhabited areas. Such of this area as is on the river side of the

Photographs by Coffey and Ganier.

FIGS. 3 and 4. Two nests of the Bald Eagle near Memphis. They were built in giant oak and elm trees and had been in use for years.

great levees is usually under water through the nesting season and this affords protection against human visitation. More than a dozen pairs are known to breed here, and a more complete census of their numbers is now under way.

There is some evidence to support a belief that the Bald Eagle has bred and may still nest in cliffs in the mountainous sections of Tennessee, North Carolina, and Georgia, this evidence being the taking of this species there during the early spring.

NASHVILLE, TENN.

THE INFLUENCE OF TEMPERATURE ON MIGRATION

BY JOHN S. MAIN

In studying the spring migration of birds it is interesting to consider the influence of the weather as affecting the time of their arrival, either at their final destination or at any given point along the way.

At the outset questions arise: What part does the weather play in initiating the northward movement? What part does temperature play? Assuming that a rising temperature at the proper season encourages migration, how high must it rise above normal in order to become effective? Does abnormally warm weather at the starting point cause an abnormally early departure? Does the temperature that prevails in the region toward which the birds are traveling affect the time of their arrival?

Most of these questions have already been discussed at length and have perhaps been answered as definitely as it will ever be possible to do, but unusual conditions arise from time to time which illustrate the play of cause and effect and help to confirm our opinions if they do not add greatly to our knowledge. Such is the case with certain events of the past two winters (1929-30 and 1930-31) and it is the striking contrast afforded by them which forms the subject of this paper.

Speaking for the vicinity of Madison, Wisconsin, where the writer resides, weather conditions during the winter of 1929-30 were, for the most part, in no way remarkable. There were fifteen sub-zero days, seven of them being −11°, or more. Once it reached −20°, and again −24°. The mean temperature for December and January was 2° below normal; from February 1 to 18 it was 4° above normal. On the latter date, however, a decided change took place. The mercury rose rapidly. On the 19th it reached 56° above zero, on the 20th, 57°, on the 21st, 60°. For five successive days the maximum all-time heat records were broken, the week ending February 25 showing a mean temperature of 28° above normal!

How did this affect migration? Let us take for examples the Bluebird, Robin, Meadowlark, Bronzed Grackle, and Killdeer, which, with the Red-winged Blackbird and Song Sparrow are the first of the small birds to arrive. Bluebirds and Killdeers appeared February 21, Robins and Meadowlarks on February 22, and Bronzed Grackles on February 26. None of these birds ordinarily arrive much before March 10, and the dates above given are, with one or two possible exceptions in the case of the Bluebird, from a week to ten days earlier

than any previous records. It may be added that on February 24 several Song Sparrows and two flocks of redwings were seen, together with large numbers of Herring Gulls, mergansers, golden-eyes, Mallards, Black Ducks, Pintails, and Coots, affording abundant evidence of a widespread movement into this area during that week. For the purpose of this study, I am confining myself to the five species first named because of the fact that, with rare exceptions, none of them winter in this region and the first individuals seen in the spring can

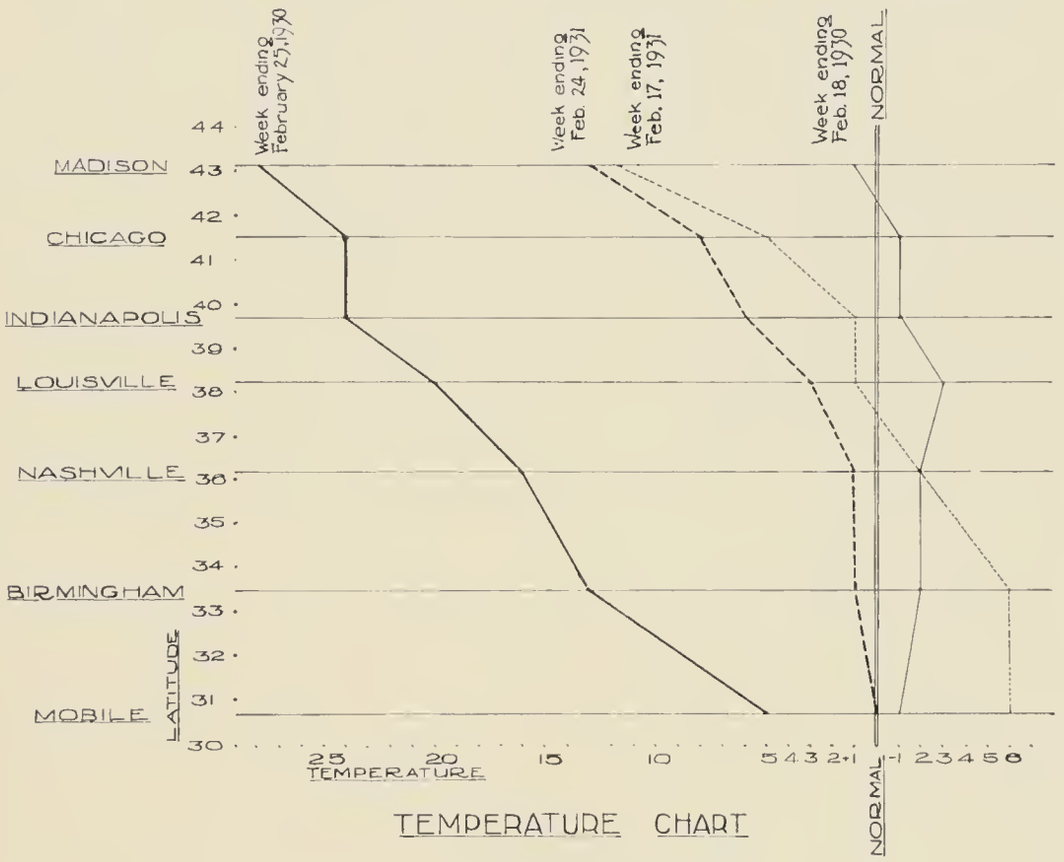


Figure 5.

be assumed to be migrants, especially if two or more individuals of a species are observed in different localities on the same day.

Let us now turn to the winter just passed, that of 1930-31. It was indeed a very exceptional one. There were only five sub-zero days. The coldest was −4°, setting an all-time record; the mean temperature for December, January, and February was the highest in 41 years; *the month of February was the warmest in 49 years.* February, moreover, was entirely free of storms, the weather generally fair, the ground bare of snow. In brief, conditions more favorable to migration could hardly be imagined.

With this state of affairs existing it might reasonably be expected that there would be an unusually early return of the first migrants, as

occurred in February of the previous year. On the contrary, of the five species first mentioned three did not appear until the first week in March, and the others not until the second week, the dates being as follows: Robins, March 4; Bronzed Grackles, March 6; Meadowlarks, March 7; Killdeers, March 9; Bluebirds, March 12. While somewhat earlier than usual, these dates were, on the average, *two weeks later than the arrival dates in 1930.* What is the explanation?

The answer to this, and possibly to the other questions raised in the opening paragraph of this article, will, I believe, be found in the sub-joined chart, which pictures for each year the conditions that prevailed in the regions to the southward during the period referred to. It shows that in both 1930 and 1931 substantially normal temperatures prevailed during the week ending February 18. In 1931 the temperatures for the succeeding week were only a little above normal throughout the wintering range. In 1930, however, the conditions were strikingly different. As shown by the chart, the temperatures during the week in question were excessively high all the way from Madison to the Gulf—so high as to incite the birds to an abnormally early departure and also to hasten the progress of their journey.

The various cities named on the chart were selected merely to show the temperatures that prevailed in certain areas, not to indicate any definite migration route. Indianapolis, for instance, has approximately the latitude of Springfield, Illinois, and their temperatures were much the same. Similarly, Mobile is made the southern terminus of the graph for the purpose of showing the extent of the warm wave of 1930, not to suggest that any of these migrants started from there. It is, however, probable that the Bluebirds and Meadowlarks wintered that year as far south as southern Illinois, while the Killdeer, Bronzed Grackles, and even the Robins may have come from Kentucky or Tennessee.

The distance covered within the week would probably be 250-450 miles, indicating a much more rapid rate of travel than has commonly been assumed for the early migrants.

All temperature records on the chart are taken from U. S. Weather Bureau reports.

Madison, Wisconsin.

A WINTER ROBIN ROOST IN ARKANSAS

BY J. D. BLACK

During the three recent winters (1926-27, 1927-28, and 1928-29) there have been roosts of varying size including the common and southern varieties of the Robin (*Turdus migratorius migratorius* and *T. m. achrusterus*) situated in and around Winslow, and during the past winter the writer had the opportunity to study their habits closely, the 1928 roost being only about a mile north of his home and containing at one time over 250,000 individuals.

Winslow, known throughout the south as "The Top of the Ozarks", has an elevation of 1734 feet at a central point in the village, and the surrounding territory, or rather most of it, is considerably higher, some places being as high as 2500 feet above sea level. The immediate vicinity of Winslow is covered with deciduous growth, the various oaks, hickories, maples, etc., being the most common trees. It has been, and still is, a considerable lumber center, with great numbers of trees being cut, leaving a heavy growth of underbrush over a large proportion of the land. The 1928 roost, being occupied from October 22 to December 16, 1928, was situated on a hill, or hills, at the head of a small ravine, facing east, although some of the birds roosted in the ravine itself, at an elevation of about 1800 feet.

The roost, when at its height, covered about a mile square, the birds never concentrating as they did in 1926, although being sufficiently thick to give the impression of immense numbers—concerning which we will deal later. The tract of land occupied has been closely cut over, leaving only occasional trees standing among the dense undergrowth, but the slopes of the ravine are well covered with small trees—nearly all second growth timber.

The first Robins arrived on October 22, and these were augmented by a few others before the first check as to the number present was made on the evening of the 24th, when an estimated number of 4,000 went into the roost. By the 28th there were at least 25,000 birds present, for six observers, covering less than half the territory surrounding the roost, reported 16,948 birds flying into the roosting grounds on that date.

The last actual check of the birds flying into the roost was made on November 7, when six observers, all well trained, covering only the south, southeast, east, and southwest, with the west half of the south section, the west, northwest, north, and northeast not being watched, listed over 74,000 birds going in. The estimates were carefully computed and the lowest figure adopted in all cases. The writer was in

the roost at the time of the flight and knows that more birds arrived from the north, northeast, and northwest, than from other directions, and believes that an estimate of 150,000 birds at that date is extremely low. The figure probably would have exceeded 200,000. Many more birds arrived after November 7 and at the time of their departure, on December 16, there were at least 250,000 birds roosting on this tract.

Due credit should be given here for the assistance of Robert Adkins, Paul Vandiver, Allen Land, and my brother, Olan H. Black, for their valuable assistance in helping check the flight of the birds, and to Paul Vandiver, Omer A. Winn, and Leonard Wallace (the last named accidentally shot and killed himself November 18, while hunting bobcats within the boundaries of the roost) for their generous assistance in the banding work carried on at night.

A study of the time of arrival of the birds at the roost, in relation to the direction from which they came, together with their speed of flight, and the time required for all the birds to pass over, leads to several interesting conjectures as to the distance covered in their search for food.

The check of October 28, being the most detailed from this standpoint, and covering the widest range of observation points, will be used to bring out these facts, the larger flights on later dates differing only in the number of individuals involved.

On this date my brother and Paul Vandiver worked together on the southeast, Robert Adkins handled the southwest, and I the east, while others were posted along the west, but it is regrettable that these observers (on the west) left their posts too soon for their work to be of any value on this point, and their reports have been eliminated.

From the southeast the first bird arrived at 4:25, and the flight proper commenced at 4:32, continuing almost steadily until 5:22, with the majority of the birds passing between 4:46 and 5:10. Seven thousand, eight hundred and ninety-two birds were listed from that direction, 3,000 from 4:56 to 5:00 P. M.

From the east I recorded the first bird at 3:45, five stragglers going in at that time, and five more at 3:49, while the flight proper commenced at 4:31, with a flock of 100, and continued until 5:10. The main body passed from 4:40 until 5:05, with 2,400 going over during the five-minute period from 4:45 to 4:50. The observations of Robert Adkins on the southwest coincided closely with those of myself, and were, on the average, ten minutes earlier throughout than the southeast reports.

The birds flew at an average speed of twenty-five miles per hour, being timed in various manners, on several different dates, the early arrivals sometimes flying as slowly as twenty miles per hour, and the late ones as fast as thirty.[1] On cloudy, dark days the birds would fly somewhat faster than on clear days, and would come in about fifteen minutes earlier. On clear days they usually made considerable commotion flying over, while on cloudy days they scarcely made a sound, flying as though the most important object in their lives was to get into the roost and comfortably settled before darkness overtook them.

The birds that came in from the southeast, and which arrived on the average ten minutes later than the others, all passed directly over Winslow and a strip of land from two to three miles wide that was barren, or nearly so, of the food they demanded. This distance possibly explains the difference in the time of arrival, but does not exactly coincide with the ten minute variation in the time. It is evident that they ranged slightly farther than the others.

Assuming that the Robins all left their feeding grounds at the same time, and traveled at the speed of fifteen miles per hour, occasional stops included, (flight speed of 25 miles per hour, allowance thus being made for rests, whether they were taken or not cannot be determined definitely, but it is supposed they did), and assuming that the first arrivals fed nearby, the conclusion would be reached that at least part of the birds fed at a distance of twelve and a half miles from the roost—the speed of flight being fifteen miles per hour and the period of flight covering fifty minutes over the southeastern sector. These are, of course only approximate figures, but have been pretty well substantiated by reports from points ten to fifteen miles away of flocks of Robins flying toward Winslow in the evening and appearing again from that direction in the morning. Some of the birds that appeared from the east during the first fifteen minutes of the actual flights often were seen coming from the trees of the first mountain east of the point of observation, while the late arrivals always were flying high and straight, as though from a great distance.

The birds lived, for the most part, on the berries of the Black Gum (*Myassa sylvatica*) during their stay here, although they con-

[1]Two methods of calculating the speed of flight were used. The first method required two observers, with synchronized watches, located at different points. A given bird was timed by each observer as it passed his station, and the records were later compared. The second method was operated by a single observer who timed a flying bird as it passed two points a known distance apart. The first method was discarded as unsatisfactory, and figures derived by the second method are used in this paper.

sumed vast quantities of the small Fox Grape, as well as various other berries that were available at that time of the year.

The Black Gum produced enormous quantities of berries last season and thus furnished food for these birds for a considerable period of time, the only logical explanation for their long stay here, and the reason for their leaving as well; for after the 18th of December hardly a berry was left on any of the gum trees I saw, and the same condition was reported by others for several miles around Winslow. The birds were observed to go into the roost in the same vast numbers on the evening of December 16, but not so much as a single bird was again seen until February 18, when they re-appeared in small numbers for the breeding season.

Most interesting to me of all was the behavior of the brids in the roost in the evening as they came in, and I spent several evenings in this study, making photographs of the birds while in the roost. Two typical days were the 30th of October and November 7.

To quote from my notes of October 30: "Robins were everywhere, and thousands more coming in all the time. Robins flying from the north, east, south, and west in continual streams, there being Robins coming to rest in trees nearby, others flying over hunting for suitable resting places, and still more Robins coming into sight on the horizon."

"They were in a singing mood and sometimes as many as five or six hundred would be singing at the same time! There was also a continual chattering and chirping as the birds settled down, this being underway when I arrived and still going on when I left."

Again on November 7, when there were many more birds present: "While the boys were checking the flight this evening, I was again on the hill where the Robins were settling and it was marvelous to watch, with many, many birds coming in. I arrived on the hill about 4:30 and left an hour later, and aside from the continual chirping and chattering the birds made another sound—like that of rain falling on dried leaves—caused by the birds' wings brushing the leaves as they went in and out of the bushes. This sound was continuous and very noticeable. They were singing very little this evening and never did I notice more than ten or twelve birds singing at the same time."

On an occasion or two I firmly believe that I heard as many as a thousand of these birds singing at the same time, the song accompanied by the rushing sound of wings: and the din of their incessant chattering as they settled down was a sound that made a deep and lasting impression on my mind—one that I will be able to recall vividly many

years from now. The birds that were singing would invariably seek the upper limbs of the large leafless trees, and sometimes I have seen forty or fifty birds singing in a single tree. You who have thrilled at the song of a single Robin in the springtime, can, possibly, imagine the effect of a thousand of these gifted vocalists in full song during the bleak days of early winter.

There was almost every conceivable plumage and type of Robin in the roost. Many semi-melanistic birds were there, very dark specimens, one being observed that possessed glossy black under tail coverts, while the others (of the dark type bird) usually had a blackish effect on the back and the rufous of the breast was considerably darker than the typical variety which breeds here. There was a third type—besides the common and the dark plumaged birds—which I have never been able to convince myself was referable to either *migratorius* or *achrusterus*, and certainly not the western variety (*propinquus*). They were considerably larger than the ordinary Robin and very pale, the feathers being distinctly edged with whitish, the rufous of the breast in some cases being exceptionally faint, and the white spots on the tail very large. All three types of birds roosted separately and were decidedly different in their behavior when captured. We knew the birds as Types One, Two, and Three, in the order described, (Type One, the blackish birds; Type Two, the typical *migratorius* and *achrusterus;* and Type Three, the large, pale birds), and found this a convenient way of referring to them.

With the assistance of the helpers previously mentioned I caught and banded an even hundred birds, all of which were reported as *migratorius*, because of the fact that there were so many hybrids and phases of plumage present that it was impossible to classify the birds properly, particularly at night, as to the subspecies. Type One never made a sound when captured and these birds were the delight of the entire banding crew. They seemed to roost in more open localities than either of the other two types, while the large whitish birds, the Type Three, were exceedingly difficult to capture, being very wary, always the first to take wing, always screaming loudly when netted, and roosting in the most inaccessible portions of the cover.

The birds banded were captured, in most instances, with a large, specially constructed net, much on the order of a butterfly net, only many times stronger, and somewhat larger. Some birds were caught by hand, and a few in a very small net, which was particularly useful in the very dense underbrush, where it was impossible to take the larger net, much less attempt to use it.

Dry, moonlight nights were excellent times to observe the restless traits of these birds, but it was impossible to even approach them on such occasions, they taking alarm a full hundred yards ahead, and flying off into the night in flock after flock; they made a roaring noise like thunder as thousands of birds took wing. They would occasionally fly a considerable distance but usually stopped, even on bright nights, after a flight of one or two hundred yards, and on dark nights they would go only a short distance.

The best time for banding work was on a very dark night, just after a rain, when the leaves underfoot were damp, allowing one to walk without making a crackling sound. Our best work was done in about three hours on such a night, when we banded thirty-nine birds. We would leave a burning lantern in the old timber road—this was necessary to keep from becoming lost—and would work on either side of the road with flashlights, spotting the bird and netting him, in this manner sometimes catching two at a time. Only one injury, a broken leg, resulted during the entire period, and this was caused by inexperience on the part of the captor, who became very adept after this accident. The bird injured was a large pale bird, belonging to Type Three, but the specimen was not preserved. The disturbance caused by a capture was great, but the birds were very capable of flight in the night, and soon were again at rest.

Both Barred and Great-horned Owls preyed continually upon the Robins, as did the bobcats, and house cats that had become feral. Red-tailed Hawks were usually to be seen sailing over as the birds came in late in the evening, but I never noticed any disturbance caused by the hawks, nor did they seem interested in the many Robins flying about.

The deep, gutteral "meow's" of the bobcats as they stalked their prey nearby and that almost terrifying snarl as they made the kill furnished a regular thrill that served to make the night work interesting. Assured by old hunters that they were perfectly harmless, I was confident that they would not attack; yet being continually followed by from one to four of these animals as they softly padded along uttering a regular purring "meow" always made me uneasy.

The most blood curdling sound of the woods was made, however, not by the cats, but by the Barred Owl, when after killing a bird he would let forth a medley of unearthly hoots, squawks, and screams that sounded as if the demons of Pandemonium were paying a personal visit to the roosting grounds.

On several occasions both species of owls as well as the cats would make kills so near that the dying sounds made by the Robins could be heard distinctly, the cats being particularly unmindful of our presence in this respect, one cat killing three birds within twenty-five feet of a party of four one night within a very few minutes. The toll these raptores and cats collected from the flock was enormous.

A résumé of the study produces these evident facts:

First, that the birds of the entire country—as shown by plumage variation—flock and feed together during the winter season, but segregate into small bunches, probably family groups and units of such, of their own race, at night.

Second, that in feeding they cover a radius of at least twelve miles. Thus the birds of a single roost range and feed over a territory of somewhat more than 452 square miles, at the least estimate.

Third, that their migration during the winter is decidedly irregular and determined solely, or nearly so, by the presence of desirable food.

And Fourth, that in banding together to protect themselves from their enemies they defeat their own purpose, as do most other birds with this habit, and, instead, open themselves to the united attack of every possible enemy for miles around.

Winslow, Arkansas.

CURVATURE OF WING AND SOARING FLIGHT

BY WILLIAM BREWSTER TABER, JR.

In his paper, "The Soaring of Raptorial Birds",[1] Mr. Palmer has brought our attention to the fact that soaring is made possible by upward moving air currents. However, in his explanation of the phenomenon he considers the wing to be flat. I would like to point out that the concave curvature of the under surface of bird wings is an essential factor in soaring flight, and the effects derived therefrom. The principle involved is identical with the principle of the impulse steam or water turbine which has been utilized in a commercial way by mechanical engineers for a hundred years or more.

In order to understand the principle it will be necessary to resort to a diagram employing the devices which engineers use. In figure 6 the heavy curved line *CD* represents the cross section of a bird wing, *C* being the thick, front edge. The bird is travelling to the left, horizontal to the ground as shown by the direction of the arrow above it.

[1]Wilson Bulletin, March, 1931, pp. 18-24.

The letter *D* is the back edge of the wing (the tips of the secondary wing feathers).

In this whole discussion it must ever be kept in mind that the bird is entirely free from the ground, that the direction of air currents as observed from the ground does not affect the flight, but that flight is affected only by the relative direction of the air currents in relation to the wing. So as to make this more clear let us imagine that the bird is soaring in a horizontal position a mile above the earth, and that you, gentle reader, are a very minute creature, say a louse, perched on the front edge of the wing at *C*. Then the direction of the air current as observed by you would be identical with the direction of the current upon the bird wing. The fine lines in the diagram

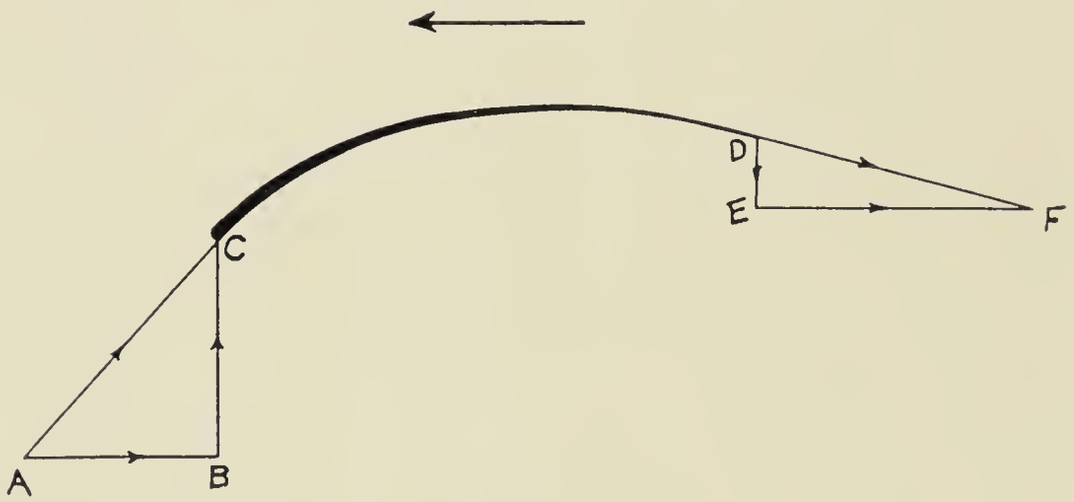


FIGURE 6.

such as *AC* or *EF* represent the velocities and directions of the air currents in relation to the wing. The direction of the current is shown by the arrow on the line representing that particular current, and the velocity of the current is represented by the length of the line.

Now to simplify matters let us consider our bird to be soaring to the left in an exactly horizontal direction in a current of air exactly straight up from the surface of the earth. The speed of the current upwards and its direction is represented by the line *BC*, the speed and the direction of the air rushing past the wing to the right is represented by the line *AB*. But since both air currents are acting on the wing at the same time, to you perched on the edge of the wing at *C*, there would seem to be only one current blowing and that would be in the direction of *AC* and its velocity is represented by the length of *AC*. It is easy to understand then, that so far as the effect upon the wing is concerned there is only one current acting upon it, and this is

represented in direction and speed by the line *AC*. In technical language the engineer calls this line *AC* the resultant of the two components *AB* and *BC*. If you can completely grasp this idea the rest is easy.

From the diagram it is evident, that under the particular conditions illustrated, the resultant current *AC* is of such a direction that it just slips in under the edge of the wing at *C*, sweeps around under the curved surface and off at *D* in the direction *DF*. Let us now suppose an ideal condition in which there is no friction between the current and the wing. Then the current leaves the wing at *D* with exactly the same speed at which it enters at *C*. Therefore I have drawn the line *DF* exactly the same length as the line *AC*. Now what effect has the change in direction of the current had upon the wing? To discover this it is necessary to separate the line *DF* into two components, one vertical and the other horizontal, for we wish to find out if the change in direction of the current caused by the curvature of the under surface of the wing tends to overcome the force of gravity which acts vertically (hence the vertical component), and tends to thrust the bird forward in the direction in which it is soaring (hence the horizontal component). These two components of the line *DF* are *DE* and *EF*. In other words the effect of the velocity of the current acting on the wing as represented by *DF* is equivalent to the combined effects of the velocities of two distinct currents, one acting straight downward with a velocity represented by *DE*, and the other straight backward with a velocity represented by *EF*.

Now it can be seen that the total lifting effect upon the bird is due not only to the lifting effect of the rising air current as represented by *BC* but in addition there is a lifting effect caused by the change in direction of the current due to the curved under surface of the wing, and this lifting effect is proportional to the length of the velocity line *DE*. Thus the total lifting effect is proportional to *BC* plus *DE*, which is considerably greater than *BC* by itself. If the bird is to maintain its altitude and still soar in a horizontal direction, *BC* plus *DE* must be of sufficient velocity to produce a lifting effect just great enough to overcome the force of gravity. If a greater lifting effect is produced the bird will rise. If a lesser lifting effect is produced the bird will lose altitude.

Now let us discuss the horizontal motion of the bird. By comparing the lines *AB* and *EF* it is readily seen that *EF* is longer than *AB*. Since the horizontal component of the line representing the velocity

of the air rushing out from the back edge of the wing, that is *EF*, is greater than the horizontal component of the line representing the velocity of the air rushing in under the front edge of the wing, there must be a thrust forward caused by this increase of velocity. The thrust forward will be therefore proportional to the difference in the length of the lines *EF* and *AB*. As in this particular ideal case there is no friction, the bird's velocity forward would be increased.

In practice, however, there is always some friction. Then too there is some loss of energy caused by eddying air currents under the front edge of the wing at *C* due to the resultant air current *AC* having such a direction that it does not exactly slip under the front edge. However it must be said that birds are able to make remarkably large adjustments of the slope of the wings in relation to the direction of flight as is so plainly shown in the admirable photograph of the Common Tern by Olin S. Pettingill, Jr.[2] Also there can be no doubt but that adjustments of the slope of the wings are automatically and continually made during soaring flight even though they may be so slight as to be unobservable by a person watching the bird. In spite of the quick and automatic adjustments that are continually being made there must nevertheless be in actual flight some losses caused by eddies and friction. Therefore *DF* can never be quite as great as *AC* and consequently the components *DE* and *EF* must be somewhat shorter than as shown. If the sum of *BC* plus the true *DE* is of sufficient magnitude to overcome the force of gravity the bird will rise, if not the bird will lose altitude. If it is only just enough to overcome the force of gravity the bird will just maintain its height. If the true *EF* is greater than *AB* the bird will increase its horizontal speed, if equal to *AB* it will just maintain its horizontal speed, if less than *AB* it will lose in horizontal speed.

There are countless adjustments and combinations of adjustments of wings, tail, position of head and legs whereby the bird may control the thrust forward and upward, which are too intricate and complex to discuss at present. However important these adjustments may be to successful soaring flight, it is certain that the essential factor is the concave curvature of the under surface of the wing, by means of which the directions of the air currents are changed, causing the necessary lift and forward thrust.

Greenwood Farm,
Kansas, Ill.

[2]Wilson Bulletin, September, 1931, Fig. 40, page 170.

CHARLES W. AND TITIAN R. PEALE AND THE ORNITHOLOGICAL SECTION OF THE OLD PHILADELPHIA MUSEUM

BY FRANK L. BURNS

The establishment and educational value of Peale's Museum, the first great public exhibition of objects of art and the natural sciences in America, was due to the tremendous energy and enthusiasm of the original proprietor and to its favorable reception by the public. The elder Peale personally collected, prepared, and placed on exhibition many indigenous species and, by purchase or exchange, a great number of exotic species of birds; corresponded with Saint-Hilaire, Cuvier, Lamarck, Weid, and Latham; exchanged with the great scientific museums of Europe and was visited by Humboldt and other distinguished travelers; yet the scientific importance of this pioneer institution, today, is almost entirely due to a small though reliable clique of Philadelphia naturalists, mostly ornithologists, who had either designated Peale specimens as their types, or more frequently, made this museum the repository for their type specimens.

Peale was famous for his natural ability and extraordinary industry as a portrait painter, especially of Revolutionary patriots, and for his great originality as a museum preparator; but he has not been conceded a permanent place among the early American naturalists, although his contributions toward the awakening of the popular interest in the subject, especially ornithology, has doubtless exceeded that of all his American predecessors.

Charles Willson Peale was born at Chestertown, Maryland, April 15, 1741; apprenticed at the age of thirteen years to an Annapolis harnessmaker; began painting portraits with little instruction until members of the Governors' Council sent him to London where he studied under Benjamin West, 1767-69. In 1774 he removed to Philadelphia and set up his studio under the patronage of Cadwalader, Dickinson, and others, and in 1776 he was commissioned an officer in the militia, which gave him opportunities to meet and paint his fellow officers. In a recent exhibition of his paintings there was shown a portrait of the great Commander-in-Chief, painted on a piece of blue and white twilled bed-ticking, while encamped at Valley Forge.

Captain Peale was indeed an indefatigable worker; his museum originated about 1784 in a frame annex to his residence on Third and Lombard Street, and from a portrait gallery, gradually embraced,

in the language of the original American showman, "everything that walks, creeps, swims, or flies, and all things else".

In 1792 he discovered the modern methods for the preservation of birds and beasts, and as he devoted almost his entire time to this work, his industry soon outgrew the accommodations and his collections were removed, in a spectacular parade of all the boys of the neighborhood, to the American Philosophical Hall, 1794.

The earliest museum publication I have seen bears the date of 1796, and although devoted to the quadrupeds, is entitled: "A Scientific and Descriptive Catalogue of Peale's Museum". Later the official title became the "Philadelphia Museum", though both Wilson and Ord designated it by the original name. In an introduction to a course of lectures on natural history delivered at the University of Pennsylvania in 1799, Peale remarked: "So irresistibly bewitching is the thirst for knowledge with science and nature that neither the want of funds, nor the leisure from other occupations, could damp my ardour". The text of these lectures has not been preserved, nor scarcely a scrap of technical matter, though the museum press printed its own guidebooks and pamphlets.

The Legislature having vacated in 1802, Peale was granted at a yearly rental of $400 the use of the State House, in which to exhibit his collections. This was the year in which the Franco-German Rafinesque landed and almost immediately described four supposedly new species of Javanese birds "dans la cabinet de M. Peale".

By 1805 Peale ingenuously stated that "there are in this collection, perhaps all the birds belonging to the Middle, many of which likewise belong to the Northern and Southern States, and a considerable number from South America, Europe, Africa, Asia, New Holland, and the recently discovered islands of the South Seas. The number exceeds 760 without the admission of any duplicates, contained in 140 cases".

Though he stated that each species was correctly identified and labeled with the Latin, English, and French names (with many nondescripts) actually there were many misnomers and no adequate catalogue, for the talented proprietor lacked the patience of the naturalist to study and make known this remarkable collection. He compared his specimens with the figures or descriptions of Catesby, Edwards, Pennant, or Linnaeus; and a refugee, Baron de Beauvois, helped him to identify some species by means of Buffon's works and to compose the French edition of the guidebook. Peale may have painted some of his subjects, and he did some engraving in mezzotint.

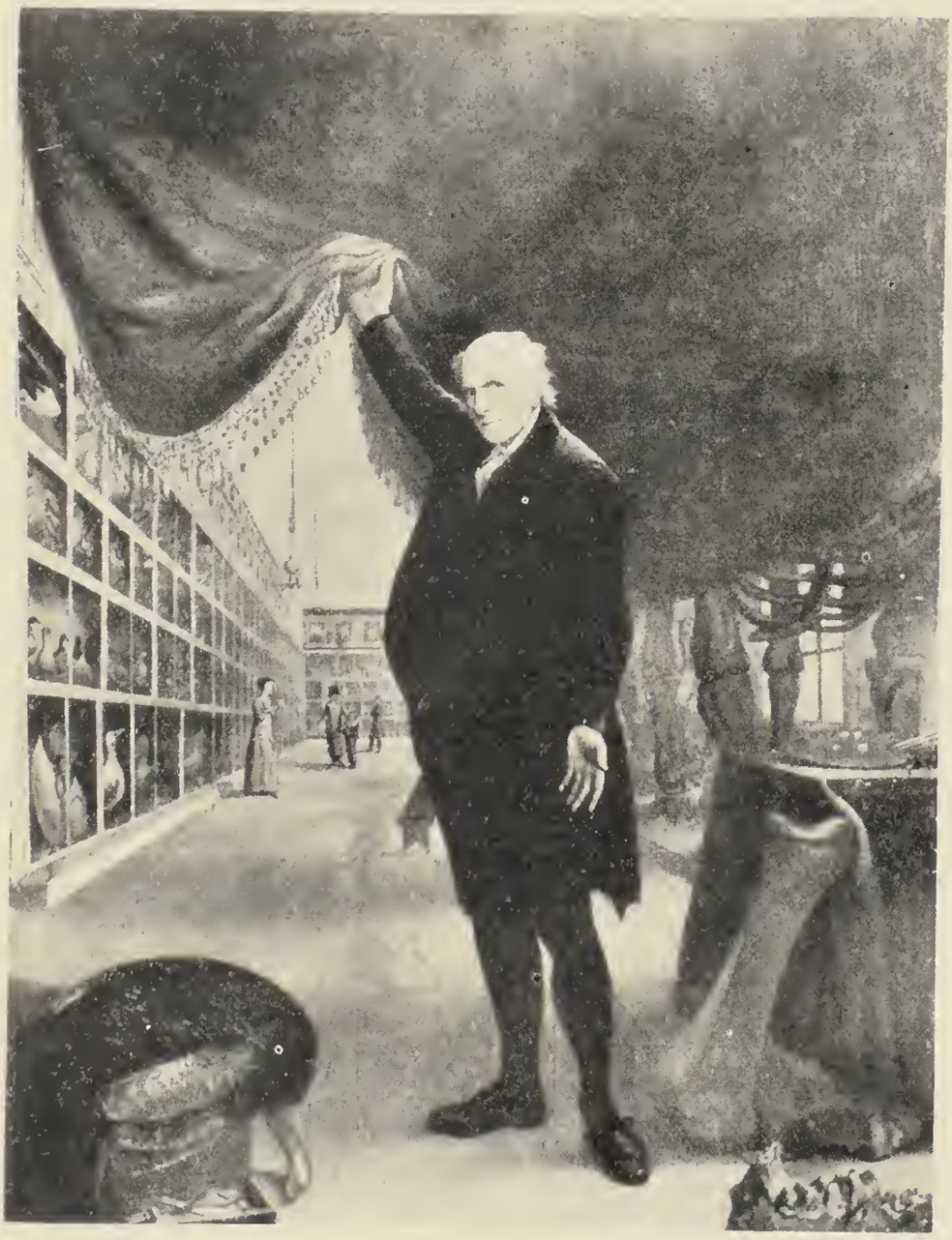


Fig. 7. Charles Willson Peale, and the Long Room of the Philadelphia Museum.

A manuscript, briefly descriptive of the collection, appeared in "A walk with a friend through the Philadelphia Museum, by C. F. Peale", preserved by the Pennsylvania Historical Society. It is undated though obviously it cannot be placed later than 1805. This ancient document is quite lengthy and evidently intended either as a rough draft of a résumé of his lecture in the mammal and bird rooms, or a serious attempt to compose a popular handbook. The "friend" is guided to Independence Hall and his attention called to the inscription on the front of the building, viz., MUSEUM. GREAT SCHOOL OF NATURE; and to the legend over the back door, viz., SCHOOL OF WISDOM. Admission and pamphlet cost twenty-five cents, and for the instruction of those who wished to know the Linnaean classification of birds, on the side of the door entering the long room on the second floor, a large frame contained the several orders and genera with the characters of each.

Knowledge of the arrangement at a later date appears confined to a series of numbers from 11 to 7789, applied by the curators to the types of Wilson, Ord, Say, and Bonaparte, the representatives of nearly 250 species and 300 specimens deposited or indicated by the above persons or by the Lewis and Clark Expedition (1804-5) and the Long Expedition (1819-20). It appears substantially the same as the antiquated Linnaean system with some adaptations to meet the requirements of the exhibition. A definite space seems to have been reserved for later accessions to all genera, though in some instances, especially the *Sylvia*, an overflow had occurred. There were many inconsistencies, for instance the Raven appears classed, probably for convenience, with the birds of prey, and the Kingbird with the shrikes; but in the latter Linnaeus had been followed; and better judgment than many contemporaries had shown, was evident in the inclusion of the Oven-bird, Water-Thrush, Black and White, Canadian, and Hooded Warblers with the *Sylvia*.

Peale's museum probably furnished Wilson with his only specimens of the Anhinga, Smew, Old-Squaw, Harlequin, and Labrador Ducks, Eider, Ruddy Duck, Flamingo, Scarlet Ibis, Whooping Crane, Purple Gallinule, European Oyster-catcher, Swallow-tailed Kite, besides the new species of the Lewis and Clark Expedition. It is certain that Wilson's accomplishments during his brief career as an ornithologist would have been greatly curtailed without the assistance of this great collection.

A perusal of the aforementioned Peale manuscript, which is sometimes briefly descriptive, often obtuse, but occasionally gives the im-

pression of superior discrimination, strengthens our belief that had he cared to publish the colored figures or a descriptive catalogue with original designations for his novelties, many of the new species now accredited to Vieillot, Wilson, and others, would have borne the name of Peale, even though it must be confessed that he had revealed no aptitude for technical names and descriptions.

The following extracts from his rough notes on some few species (headed by the names in current use and supplemented in some instances by confirmatory or explanatory notes) have peculiar interest as heretofore unpublished records of a very early American collector.

Sterna antillarum (Les.). A rare bird, it was blown from the seacoast across the Jerseys in a heavy storm, and dropped down in the street; we named it the Minute Tern.

Anhinga anhinga (Linn.). This was a straggler, shot at Elkridge Landing, high up the Patapsco River, (Maryland) far distant from where any were seen before. It differs in plumage from the other that was brought from Georgia. (Of this extraordinary species we can give little more than accurate descriptions and tolerably good portraits, which are taken from two fine specimens, admirably set up and preserved in the Museum of Mr. Peale, Nos. 3188 and 3189-Wilson. The Elkridge specimen has the record for being the farthest north on the Atlantic slope. Peale could scarcely be mistaken as to the exact locality since it was at no great distance from his native town.—F. L. B.).

Pelecanus erythrorhynchos (Gm.). This is one which was shot in the mouth of Chester Creek, Maryland. It is ascertained that they are found in the Chesepeake Bay; one, some years past, was taken as high as the Susquehannah. They seldom winter in our rivers although they are known every summer to be along the seacoast, especially of Egg Harbor. One was wounded up the Hudson as far as Albany some years ago.

Nyroca valisineria (Wils.). The Canvas-back duck is most esteemed for the table; a comparative view of the beak with that of the Red-head Duck (*A. rufa*) will confirm knowledge not easily mistaken, although the plumages of both species are very similar.

Camptorhynchus labradorius (Gm.). The Pied Duck deserves our notice as a rare duck, or not much known even to naturalists. They are sometimes brought to our market from Egg Harbor.

Oidemia americana (Sw.). The Scoter came from Sweden, differ from the American Scoter.

Erismatura jamaicensis rubida. The Ferrugenous Duck (*A. ferrugnea*) appears by authors to be a rare bird in Europe. This was shot on the Delaware, it is the only one I have seen. The purity of the blue of its bill while living, greatly surpassed its present appearance. (This very rare duck was shot some years on the River Delaware, and appears to be an entire new species. The specimen here figured, with the female that accompanied it, and which was killed in the same river, are the only individuals of the kind I ever met with. They are both preserved in the superb museum of my much respected friend, Mr. Peale, of this City.—Wilson).

Phoenicopterus ruber (Linn.). Flamingo. (*P. ruber*) inhabit Louisiana, the Bahama Islands, and the West Indies. It has a rather timerous than a lofty spirit. Both of these were living in our city for some time. Our climate is too severe to domesticate them.

Guara rubru (Linn.). Scarlet Ibis. (*T. ruber*) found in Georgia and South Carolina in summer. (One of them lived for some time in the museum of this city.—Wilson).

Grus americana (Linn.). Hooping Crane. (*G. americana*). (No. 3704. Dr. Mease has stated that this specimen came from the Capes of the Delaware).

Gallinago delicata (Ord). There is a snipe that is called the English Snipe. It is said to be found in every quarter of the globe under some trifling variety of plumage and size. The variety which we have here belonging to America, is considerable.

Numenius americanus (Bech.). There is a specific difference between the European (*arquata*) and the American Curlew, the under bill very much shorter on the latter in proportion to the birds; plumage of each species very much alike but the American Curlew is considerably larger than the European.

Charadrius semipalmatus (Bp.) or *C. meloda* (Ord). The Ring Plover (*C. hiaticula*) of Europe is very like a bird of which we have great numbers about Cape Henlopen.

Haematopus palliatus palliatus (Temm.). Singular is the genus *Haematopus* or Oystercatcher. They inhabit Europe and America. The darkest pair is from England, and the other from Cape May, called Sea-Pie, Pied Oystercatcher *H. Ostralegus.*

Tympanuchus cupido cupido (Linn.). Pinnated Grouse. They are numerous on the bushy plains of Long Island.

Meleagris gallopavo silvestris (Vieil.). So common a bird that it might be passed by without notice.

Ectopistes migratorius (Linn.). Migratory or Passenger Pigeon (*C. migratoria*). Visits Pennsylvania and all the middle states in prodigious flights—when our markets are supplied with vast quantities which are taken in nets.

Coragyps atratus atratus. The Carrion Crow. It is said not to go more than fifty or sixty miles from the seacoast of Carolina and Georgia. (The *Vultur atratus* of Bartram).

Elanoides forficatus (Linn.). Swallow-tailed Falcon. (A specimen now in the museum of Philadelphia, was shot within a few miles of that city.—Wilson).

Astur atricapillus atricapillus (Wils.). Black-cap Hawk. (Ash-colored or Black-capped Hawk. This bird was shot within a few miles of Philadelphia, and is now preserved, in good order, in Mr. Peales' museum.—Wilson).

Tyto alba pratincola. A great similarity of the common owl (*Flammea*) of Europe and Asia and one which is sometimes found in the vicinity of Philadelphia. The only difference between them, is the bars of the quill feathers; in all other parts of their plumage they are perfectly alike.

Asio wilsonianus (Less.). A variety of the Long Eared Owl.

Conuropsis carolinensis (Linn.). This is that small parrot with the Aurora-colored head, named the Carolina Parrot. It sometimes breeds in that country, but most of them go farther south. They migrate to the western counties of Pennsylvania. (A number of these birds, in all their grades of progressive change from green to yellow, have been deposited in Mr. Peale's museum.—Wilson).

Coccyzus erythrophthalmus (Wils.). The Black Bill Cuckow is not described; beside the bill having none of the white on the under mandible, it is also without the pale rufous quill feathers of the Carolina (*C. americanus*); not very different from the Carolina but it is obvious that they are two separate species; pairs. (Peale exchanged on February 4, 1806, with other specimen, a Black-billed Cuckoo, to Savage of the New York Museum).

Campephilus principalis (Linn.). Ivory-billed Woodpecker. It is not found near Philadelphia, though it is said to inhabit from the Jerseys to Brazil.

Epidonax virescens (Vieil.). There is another species considerably like *fusca*, but a smaller bird, whose manners also resemble it. But this species are only found in the thickest woods, they visit us about one month later than the others, this bird has not been described. Mr. Wilson, a very accurate observer, fond of natural history, gave me this account. (Peale's description is inadequate and the reference may apply almost equally as well to *Myiochanes virens*, which is Bartram's *Muscicapa subviridus* the little olive col'd flycatcher).

Corvus corax principalis (Ridg.). Few of our citizens know that we possess the Raven (*Corvus corax*); it is rarely found near Philadelphia but abounds in the western parts of Pennsylvania.

Icterus spurius (Linn.). Before we leave this genus, it is deserving of notice that authors have been under the mistake of making the black-throat, the female of the Bastard Baltimore (*Oriolus spurius*). Here we see the proper mate to each of them. (Mr. Charles W. Peale, proprietor of the museum, in Philadelphia, who, as a practical naturalist, stands deservedly first in the first rank of American connoisseurs, and who has done more for the promotion of that sublime science than all our speculative theorists together, has expressed to me his perfect conviction of the changes in which these birds pass through; having himself examined them in spring and toward the latter part of summer, and having at the present time in his possession thirty or forty individuals of this species in every gradation of change.—Wilson).

Cassadix mexicanus major (Vieil.). Boat-tailed Grackle (*Gracula barita*). It is so-called because of the folding up of the tail feathers.

Loxia curvirostra pusilla Gloger. The American species we know has charming though not loud notes; they are rare on our seacoast but very numerous in the back parts of Pennsylvania. (The *Loxia rostra forficato* of Bartram).

Ammodramus savannarum australis Maynard. The Yellow-winged Sparrow is a nondescript; green shouldered sparrow; very few of our sparrows have been described by naturalists. (Evidently Peale considered the above named two distinct species. Wilson adopted the first for his common name for *Fringilla passerina*).

Spizella arborea arborea (Wils.). The Russet-capped Sparrow is most common. (The *Passer domesticus* of Bartram and the *Fringilla domesticus* Chipping Sparrow of Barton).

Melospiza melodia melodia (Wils.). Spotted-breasted Sparrow, nest and eggs, the male a fine singer. (The *Fringilla melodia* of Barton).

Piranga erythromelas (Vieil.). Red Tanager (*T. rubra*) is found generally throughout the United States.

P. rubra rubra (Linn.). *T. aestiva*. very few come so far north as Pennsylvania, breed in Maryland and winter near the Mississippi.

Bombycilla cedorum (Vieil.). Waxen Chatterer *A. garrulis* distinct from the American Cedarbird. (Those of our fellow citizens who have still doubts, and wish to examine for themselves, may see beautiful specimens of both birds in the superb collection of Mr. Charles W. Peale of Philadelphia, whose magnificent museum is indeed a national blessing, and will be a lasting honor to his memory. Wilson).

Lanius borealis (Vieil.). The largest of this genus of birds, is our Cinerous Shrike (*Lanius exubiter*).

Vireo flavifrons (Vieil.). Many of this genus of birds have a great part of their plumage of an olive colour but same have red eyes, therefore the English term is preferable. The White-eyed Flycatcher, this is, we consider a proper name for the same reason and it distinguishes it from another species of the same size, much like it except that it has a yellow throat.

Dendroica magnolia (Wils.). Black and Yellow Warbler, male and female: a nondescript. (Mr. Peale has the merit of having been the first to discover this elegant species, which he informs me, he found several years ago not many miles from Philadelphia.—Wilson). Peale identified the "Yellow Rump (*M. maculosa*) male and female" as the Myrtle Warbler.

D. cerulea (Wils.). Blue and White Warbler, also a nondescript, a beautiful bird, rare. (Except my friend Mr. Peale, I know of no other naturalist who seems to have hitherto known of its existence.—Wilson. The merit of having discovered this bird is entirely due to the Peale family, whose exertions have contributed so largely to extend the limits of natural history. The male, which he has accurately described and figured, was made known to Wilson by the late venerable Charles Willson Peale, who alone, and unassisted, accomplished an enterprise, in

the formation of the Philadelphia museum, that could hardly have been exceeded under the fostering hand of the most powerful government. To the no less zealous researches of Mr. Titian Peale, the discovery of the female is recently owing, who, moreover, evinced his sagacity by determining its affinities, and pointed out its true place in the system.—Bonaparte).

Seiurus motacilla (Vieil.). Louisiana Warbler *Ludovicina.*

Wilsonia pusilla pusilla (Wils.). No. 1703, with a black cap, a nondescript, very small.

Troglodytes aedon aedon (Vieil.). (Having seen no accurate description of this bird in any European publication, I have confined my references to Mr. Bartram and Mr. Peale.—Wilson. The *Motacilla domestica* House Wren of Bartram).

Telmatodytes palustris palustris (Wils.). Marsh Wren and its curious nest. (The *Passer palustris* of Bartram).

Hylocichla sp.? Little Thrush (*T. Minor*). They are generally found in the retired places of our woods and very often on the ground; common throughout the United States; here are some varieties of the same kind of Thrush. (Since *Turdus minor* was based in part upon both the Olive-backed and Wilson's Thrushes of Pennant and of Edwards, Peale's varieties doubtless included the Wood, Hermit, and possibly the Gray-cheeked Thrushes. Wilson, who clarified the sparrow muddle, was less successful with the thrushes).

Certhia familiaris americanus. Bp. The plain brown striped bird belongs to Europe, Asia, and America. The American species have the throat and breast whiter than those of Europe; we seldom see birds of the two Continents so much alike. (The *Certhia rufa* little brown variegated creeper of Bartram).

The Peales kept a great daybook or "Memoranda of the Philadelphia Museum", in which were recorded the enormous accessions of specimens through donation and exchange from 1803 to 1837. Alexander Wilson's first presentation occurred July 14, 1804, and consisted of sixteen birds' nests and eggs, and almost his last, March 20, 1813, was a set of Bald Eagle eggs taken at the Great Egg Harbor bay, now in the Brewer collection, Museum of Comparative Zoology. The itemization of the miscellaneous collection presented by Meriwether Lewis by order of President Jefferson covered several pages, and the Long collection was added March 23, 1821. It was the ambition of Peale to make his collections the nucleus of a National Museum, and with this end in view, he formed a national board of visitors; but government assistance was refused, and he retired from active management in 1808, his son Reubens became curator, and Rembrandt, probably a better painter than his father, had his studio in the east room on the first floor. There seemed at that time nothing incongruous in the exhibition of Revolutionary portraits and Nature's own creations in the "Cradle of Liberty", and Peale, a participant in the battles of Trenton, Princeton, Germantown, and Monmouth, would have been the last to desecrate it.

Catalogue No. 1, which by the way was not the only one so numbered and undated, summarized the collections as follows: portraits

130 (eventually increased to 269); wax figures of Indians, etc., 80; quadrupeds 190; birds 1240 (not including duplicates); tortoises 40; lizards 112; snakes 148; fishes 121; insects and miscellaneous, exceeding 6000; fossils and minerals 1920. It is highly improbable that much of importance was added to the ornithological department after the specimens collected by Titian R. Peale on the Long Expedition and his second trip to Florida; if so, it does not appear in the records of the museum.

Under the new management, which included Raphael, Rembrandt, Reubens, Linnaeus, Franklin, and Titian Peale, it was incorporated in 1821 and capitalized at $100,000. Previous to the municipal purchase of the Independence Hall, a project was actually under way to acquire the entire south side of the square, and Latrobe was employed to design a museum to cover the site.

Soon after the death of the elder Peale, February 22, 1827, the museum was moved to the Arcade on Chestnut Street above Sixth Street, and the capitalization increased to $400,000; later a museum was built on Sansom, from Ninth almost to Eighth Street, in 1838. It was a two-storied building 70 by 238 feet, with lofty ceilings, controlled by the Peale family and Pierce Butler. The museum no longer confined its sphere to the natural sciences and fine arts, for the mechanical genius of Franklin Peale had introduced the working models of American inventions; and there were numerous other features of the dime museum caliber.

The colorwork on the plates of the Harrison Hall edition of the "American Ornithology", published 1828-29, by some considered the best colored plates of all, was done by the Lawson sisters from specimens in the Philadelphia museum, presumably the types of the original edition.

The elder Peale had married three times and his children developed mostly as artists, only one of whom, his youngest son, elected to follow the profession of a naturalist. Titian Ramsey Peale (named after an elder half-brother, who showed great promise as a naturalist and who died in his eighteenth year) was born in the Hall of the American Philosophical Society in 1800. As a youth of seventeen years he accompanied Ord, Say, and Maclure on a brief, interrupted trip to Florida; he was assistant to Say on the Long Expedition to the West, 1819-20; he was employed by Bonaparte to collect in Florida and to draw many of the birds for the continuation of the "American Ornithology", 1824; and later, on the authority of a recent writer, he

is said to have accompanied the Burrough's Party to South America, 1831, of which little is known; he was also director and curator of the museum, and illustrator of Doughty's "Cabinet of Natural History and American Rural Sports", 1830-32.

It seems that Peale and Ord had planned a private collecting trip to the Missouri about 1830; but at that time the latter was in Paris studying the French language, and the trip was never accomplished. Nevertheless, it was not all work and no play. Titian returned from the Rocky Mountains an enthusiastic archer; and after reading up on the subject especially as conducted by the Royal Society of England, in 1836 with the help of his brother Franklin, Thomas Sully the artist, Dr. Robert E. Griffith, and other prominent business and professional men, organized the "United Bowmen", destined to endure for more than thirty years.

The regulation field costume, with its gold-laced Lincoln green coat, white pantaloons, black patent leather girdle and gold buckle, tassel and greasebox, and green covered straw hat turned up on the left side with three black ostrich plumes, must have put to shame the most gaudy parrot in his father's collection. The field meets were conducted every Saturday from May to October at Bush Hill, on the south side of Fairmount Avenue near Twentieth Street (where Alexander Wilson had found the Pine Siskin, *Spinus pinus*, about a quarter of a century earlier), and the target distances were not less than 60 and not more than 125 yards—a severe test of strength and marksmanship. The punch-bowl was not the useless piece of bric-a-brac it is today, although the "hailstorm" was partaken with discretion.

Titian Peale's great opportunity came with his appointment as mammalogist and ornithologist of the Wilkes' United States Exploring Expedition, 1838-42, mainly to lands touching the Pacific Ocean; his skill and experience as an animal painter, field collector, and preparator had secured the recommendation of his friends of the American Philosophical Society, though he had heretofore scarcely written a line for publication.

C. W. Peale had written on the very first page of his journal the following aphorism (or sophism?): "I love the study of nature because it teacheth benevolence".

Apparently, upon the return of Titian R. Peale after nearly four years of travel and successful endeavor, similar invidious influences and controversies that overwhelmed John Townsend, were reenacted in the instance of another gentle soul, for others were placed in charge of

Fig. 8. Titian Ramsey Peale.

his materials and he was hampered in many ways. Ord had reassured him: "I deeply deplore the plunder of your hard-earned treasures but it is precisely what I expected. Be of good cheer my dear old friend and fellow traveller. God almighty will not abandon you. Preserve your integrity and honorable bearing, and you shall yet succeed". Peale persevered, for under the date of May 19, 1845, he wrote his friend: "We are 'getting along' here after a fashion, much in need of books and countenance; the big gun of the Exploring exped. 'has gone off', and the echo is rumbling in the distance. I doubt much whether any ammunition will be forthcoming from small arms."

His official report, rather incongruously entitled "Mammalia and Ornithology", published in 1848, included the descriptions of numerous species of birds supposedly new to science, for he had no means of ascertaining that many had been described, owing to the lack of the essential works of reference. His inexperience in work of this nature counted heavily against him, for his contribution was deemed unworthy of the series in scientific value and was suppressed by Wilkes, who had retained command until the reports were completed. In 1852 the revised edition "Mammalogy and Ornithology", by John Cassin, appeared with Peale's folio volume of colored plates, denied the first edition. It is needless to state that Cassin through the liberality of a wealthy patron had the material and necessary works of reference and that the technical descriptions and synonmy were only matters of routine to that accomplished systematist.

Quite naturally Peale was mortified when his work was rejected and destroyed, though his friend George Ord advised him that since he had incurred the hostility of his superior, nothing could be done for his reputation unless he should publish at his own expense under copyright and submit judgment to the future. Nothing further was attempted and the Peale edition is one of the rarest books on ornithology.

Peale was frequently employed by Ord, presumably in the illustration of his contemplated work on the quadrupeds, a work that would have been a credit to all concerned had it been published, but it was discontinued upon a reverse in fortune of the author, and the drawings, descriptions, and some plates engraved by Lawson, probably destroyed after a few impressions of the plates were made. Peale also, at an earlier date began an illustrated work on the moths and butterflies engraved on stone, which he never finished.

In 1845 Ord was an applicant for the position of Secretary for the Board of Regents of the Smithsonian Institution, and he wrote Peale who was still in Washington, "Should the efforts of my friends be successful, you may take it for granted that the situation of Curator will be filled by T. R. P." Ord, through Colonel Biddle, with characteristic modesty, urged the appointment of Peale and thought his chances very good, though not so sanguine of his own, and when Prof. Henry was named, he expressed his entire approval. In 1848 Peale was made Assistant Examiner of Patents, later Principal Examiner in the Division of Fine Arts and Photography, in which congenial employment he continued until his resignation in 1873. He died in Philadelphia in 1885. His name is perpetuated in North American ornithology by *Falco peregrinus pealei*, a rather pathetic reminder of the Peales, father and son, whose integrity and perseverance had contributed so much to the material advancement of American ornithology.

The Museum Company failed as a commercial enterprise long after it had ceased to be the resort of the savants of natural science. Over-capitalization and the failure of the United States Bank closed its doors at the outbreak of the Mexican War. The natural history collections were sold to Kimball and Barnum in 1850, and a small part of the ornithological relics eventually found rest in the Museum of Comparative Zoology at Cambridge, Massachusetts—some fifty-three more or less doubtful types of Wilson, Ord, and Bonaparte, the sole survivors of the Ornithological Section, except two type specimens in the Academy of Natural Sciences of Philadelphia, and one of Wilson's types in the collection at Vassar College.

The national prominence of the old Philadelphia Museum in ornithology may be said to have extended from Rafinesque's first entry, throughout the activity of Wilson, and terminated with the visit of Bonaparte, a period almost coincident with its occupancy of Independence Hall. It then passed to the Academy for a time, but there was no immediate successor to Cassin, who tolerated neither rival nor neophyte; and the Smithsonian Institution came into its own.

Berwyn, Pa.

THE WILSON BULLETIN

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The present editorial organization is as follows: T. C. Stephens, Editor-in-Chief, Sioux City, Iowa; Myron H. Swenk, University of Nebraska, Lincoln, Nebraska; Albert F. Ganier, Nashville, Tennessee; Alfred M. Bailey, Chicago Academy of Sciences, Chicago, Illinois; R. D. Hissong, Sioux City, Iowa.

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EDITORIAL

The New Orleans Meeting was a noteworthy one in many ways. Perhaps the setting and environment had much to do with its success. The total registration in the A. A. A. S. headquarters was 1,447, while at Cleveland last year the figure exceeded 2,700. While our own attendance at New Orleans fell below that of Cleveland, yet it made a much better relative showing than did the main registration, and compares favorably with the average of the preceding five years. The following figures present a statistical comparison of the Club's affairs during the past five years.

	Nashville 1927	Ann Arbor 1928	Des Moines 1929	Cleveland 1930	New Orleans 1931
Local attendance	32	31	106	41	11
Out of town attendance	43	75	96	122	81
Total attendance	75	106	202	163	92
Dinner attendance	46	50	77	98	35
Titles on program	34	24	36	33	27
Honorary members	4	4	9	7	7
Life members	----	----	5	7	7
Sustaining members	68	64	66	58	57
Active members	244	248	245	227	214
Associate members	347	383	397	479	461
Total membership	663	702	717	775	744
Total receipts	$1638	$1981	$2167	$2451	$2686
Pages in Bulletin	256	274	272	312	334

As a basis for planning our future meetings the following meeting schedule of the A. A. A. S. will be of interest:

1932. Atlantic City, N. J.
1933. Boston, Mass.
1934. Pittsburgh, Pa.
1935. Havana, Cuba.
1936. Washington, D. C.
1937. Indianapolis, Ind.
1938. Atlanta or Houston.

The American Association plans to hold a summer meeting in Chicago in 1933 (June 19-30) during the World's Fair. Now that these dates have been fixed the W. O. C. may consider whether it wishes to join in this summer meeting at the World's Fair; if so, will a winter meeting in the same year be advisable? It is interesting to note that the American Association is planning to use $75,000 to bring to this meeting seventy-five scientists as guests from foreign countries.

The New Orleans meeting was productive of several changes in our official list. The officers and councillors were at this meeting elected under the new constitution which was adopted a year ago at Cleveland. Dr. Jesse M. Shaver, who has been Secretary for three years, was made President. His active and efficient work in the Secretary's office has placed the organization under deep obligation to him.

Professor E. L. Moseley, who was made First Vice President, has been, since 1914, the professor of Biology at Ohio State College, Bowling Green, Ohio. Besides being a member of various scientific societies, Prof. Moseley has written several books and numerous papers in various fields of biological science. He also has the honor of having named after him a fish, a bird, and a species of golden-rod. Prof. Moseley is also credited with having discovered the cause of a disease known as "the Trembles", or the milk sickness. He was a member of the Steere Scientific Expedition to the Philippine Islands in 1888.

Dr. Josselyn Van Tyne, who was elected Second Vice President, is now Curator of Birds in the Museum of Zoology of the University of Michigan. He is a graduate of Harvard University, received his Ph. D. from the University of Michigan in 1928, and remained there. He has worked out some excellent life history studies of birds at Barro Colorado Laboratory in Panama; and was ornithologist with the Kelley-Roosevelt Expedition to Indo-China in 1929, and also with the University of Michigan Expedition to British Honduras and Guatamala in 1931.

Our new Secretary, Mr. Lawrence E. Hicks, is a young man who was graduated from the Fredericktown High School in 1923. In 1928 he received the B. S. from Otterbein College, and in 1929 he received the M. S. from Ohio State University. He is now pursuing work for the Ph. D. while serving as instructor in the Department of Botany in the same university. He is a member of the Ohio Academy of Science, A. A. A. S., American Botanical Society, American Ecological Society, Wilson Ornithological Club, American Ornithologists' Union, Sigma Xi, and Gamma Alpha. His interest seems to be about equally divided between Botany and Ornithology, and he has done a splendid lot of research in both fields. He has accepted the heavy duties of his present office with enthusiasm, and we are certain that he will receive the cordial support of our members.

The W. O. C. Library is in need of a book-plate. Members who are interested in such matters are invited to submit designs for a suitable book-plate for the books of the Club's Library. From those submitted a choice will be made and announced at a future time. No decision has been made, but it is probable that the book-plate should have a space for the accession number; and possibly also a space for the donor's name.

It Is Interesting to note that the electrical devices which Mr. Baldwin has been using to determine the temperatures and the comings and goings of birds in the nest are now being placed in cribs to register the behavior of human babies.

GENERAL NOTES

Conducted by M. H. Swenk

A Snow Bunting Banded in Michigan Shot in Greenland.—A bird banding return came to me today (December 14, 1931) which gives me the following information: "You will be interested to know that information has been received to the effect that a Snow Bunting (which I) banded on February 17, 1931, was shot by R. Harring at Igdlorpait, Julianehaab District, Greenland, on April 30, 1931."—Oscar M. Byrens, *McMillan, Mich.*

The Barn Owl Nesting in Southeastern South Dakota.—A pair of Barn Owls (*Tyto alba pratincola*) nested by the James River near Yankton in the summer of 1931. I was out of town when the nest was found, about the middle of August. It was made a news item, containing a description of the young birds, and stating that no one knew whether they were eagles, hawks, or owls. Of course it was not difficult to decide between these. On September 17, the young birds were still in the nest. I have seen very few Barn Owls here, but am particularly surprised at their nesting so late in the season.—A. P. Larrabee, *Yankton College, Yankton, S. D.*

Red Crossbills at Viroqua, Wisconsin.—On August 6, 1931, I had the pleasure of having a small flock of Red Crossbills (*Loxia curvirostra pusilla*) come to the bird bath. Glancing from the window, two birds caught my attention as being different from the usual birds that frequent our small place. Out doors with my binoculars I was able to steal up to within about twenty feet. There were six, all in the bath at one time, fluttering and throwing the water about. They were quite unafraid and undisturbed by anything around them. It was easy to distinguish the crossed bills in the short time that they remained.—Margarette E. Morse, *Viroqua, Wis.*

Florida Gallinule Eats Goldfish.—On April 23, 1931, a live Florida Gallinule (*Gallinula chloropus cachinnans*) was brought to the Buffalo (New York) Museum of Sciences. It was given the run of the corridor in the preparator's department, and often jumped into an open aquarium, where it fed upon water plants. Four days after its capture it was observed to eat a dead goldfish which it flailed against the concrete floor before eating it. The bird became very tame and by April 29 it was greedily accepting bits of raw beef tossed to it from the distance of one foot. On the following day the bird took food from its owner's hands.—Louis B. Kalter, *Dayton, Ohio.*

A Spotted Sandpiper Incubates Five Eggs.—On June 28, 1931, while serving as a ranger naturalist in the Educational Division of the Department of Interior, at Old Faithful in Yellowstone Park, Wyoming, I found, along the bank of the Firehole River, a Spotted Sandpiper (*Actitis macularia*) on its nest. The nest was in an ideal location on the south side of the bank and sheltered by an overhanging tuft of sod.

Upon chasing the adult bird from the nest I found five spotted dark brown eggs. Five eggs are rather an exception to the rule. Most literature citations and records from observations show that the Spotted Sandpiper lays and incubates four eggs.

I visited the nest on each of the following three days, and it was empty on the third day, when the mother and young were nowhere to be found.—George A. Smith, *Brown University, Providence, R. I.*

A Red-bellied Woodpecker Robs a Sapsucker.— In December, 1927, I noted a Yellow-bellied Sapsucker (*Sphyrapicus varius varius*) on one of the sugar maple trees in our yard. He was busily engaged in drilling rows of holes around the larger limbs of the tree. I could see he had already constructed a large number of these miniature wells, which he toured from time to time. Each day he would come to the tree around 11:00 A. M. and would spend there from an hour and a half to two hours or more. One day as I was watching him make his rounds, he had a caller—a Red-bellied Woodpecker (*Centurus carolinus*). Immediately upon arrival the latter began to eat at the Sapsucker's holes. Indeed, he was hard to fill, and would fly at the Sapsucker, causing him to dodge around a limb in order to keep out of the way. Resentment seemed to be on the wrong side. The Sapsucker bore the intrusion patiently and without vociferation. Several times thereafter I saw the robber still working at his holdup game.—N. M. McGuire, *Nelson, Mo.*

Bank Swallows Killed by Automobiles.—On July 23, 1931, with Mr. and Mrs. J. H. Hollister, we noted ten or twelve dead Bank Swallows on a graveled road about a small lake about twenty-five miles southeast of Fargo. While driving near the same place on July 26 we found a group of fifty to one hundred birds on the telephone wires and about as many on the roadway. It was necessary to slow down to avoid striking them. Mr. and Mrs. W. E. Brentzel report that near Pelican Rapids, Minnesota, they saw on the same day large numbers of birds on dead trees, telephone wires, and on the road. In three places the roadway was black with dead birds, estimated at a total of 1,000. Both of these instances were on graveled roads on very warm days. The Brentzels state that large numbers of birds have been seen at this particular place in other years, but not the dead birds. A low meadow adjoins the road on one side and a farm house is located on the other, but there is no bank nearby.—O. A. Stevens, *Fargo, N. D.*

Some Brief Bird Notes from Indiana.—The *Aralia spinosa* berries are relished by Robins, Red-eyed Vireos, and other birds in the fall. The common Pokeberry is a source of great delight for Robins in the late fall. I have seen six Robins at one time feasting in one bush. Frozen apples that have been left on the tree are liked by many winter birds. Snow Buntings, which are very rare in this part of the country (I have known them to visit this place only once), feed upon weed seeds, even when the snow is very deep, and will jump upon a weed, breaking it down, and will then eagerly devour the seeds. Birds change their diet many times, according to the supply.

Robins almost all departed during August in 1930 and 1931, leaving but a few stragglers with us. I have travelled in eight other states during the time the Robins were the most plentiful, and find that in no place are there such a great number of these birds as in our own vicinity. I wonder why this is true? In many places for some reason we found few if any Robins. I think the Bluebirds are increasing in number in many places. Red-headed Woodpeckers are killed more than any other species of birds by autos, I think. I believe it is because they are clumsy and cannot get out of the way. The Yellow-breasted Chat is to be found in this part of the country often now, but formerly it was rare. It nests near this place, and I have made a thorough study of its habits, home and song, and find it a most interesting bird. It nests in wild cut-over areas that man seldom visits.—Mrs. Horace P. Cook, *Anderson, Ind.*

Worthington's Marsh Wren in the Vicinity of Savannah, Georgia.—Wheeler's paper on Marian's Marsh Wren in the December, 1931, issue of the Wilson Bulletin makes it seem desirable to mention some facts about the local race of the Long-billed Marsh Wren breeding in this section.

Worthington's Marsh Wren (*Telmatodytes palustris griseus*) is one of the common birds near the Georgia-South Carolina line, on the coast and in its particular habitat. The type locality of the subspecies is given in the A. O. U. Check-List as Sapela Island (Georgia) some forty or more miles to the southward. To list the localities frequented by this species during the summer would take up too much space here, but along the Savannah River I have found it from the salt marshes on the coast to about two miles west of Savannah—a distance of about seventeen miles inland from the outer islands. This includes several miles of territory designated by Wayne (Birds of South Carolina) as the River Rice Fields. Here we find such fresh-water plants as the Pickerelweed (*Pontederia*), Arrowhead (*Sagittaria*) and various others. The birds nest here in tall reeds or marsh grass along the river banks, and the little drains and canals of the abandoned rice fields. The river water is either fresh or brackish, according as to the river is high or low.

Farther toward the coast they live and nest in high grass at the edges of the many waterways, as well as in the salt and brackish ponds of the coastal islands. I have never found one of their nests in a tree, and never in any place not directly over muddy shores or over water. The usual globular nest is made, and the materials vary according to the locality and convenience. Near the city docks fragments of cotton that have drifted across the river are woven into the nest with other suitable material.

The nesting time varies greatly, and if a second brood is raised, the birds must move well away from the first nesting site. I have found eggs in late April, and from then until July 24, though in different years. One colony located conveniently (for observation) in 1925 had many eggs through June and then an occasional set until late July. About three nests in eight have five eggs; that is one *occupied* nest, for many of the so-called "bachelor" nests are always to be found. I have not found a set that I believed to be complete with less than four eggs. The eggs are often covered with a soft cushion, and after incubation is started this cushion is usually drawn into the opening when the bird is absent.

It is not usual to find the eggs muddy, as with the clapper rails, the gallinules, and the seaside sparrows nesting in the same muddy marsh, which seems to indicate that the wrens do not descend to the mud, but travel along the grass stems and drifted sedge in search of food and nesting material.—Ivan R. Tomkins, *Savannah, Ga.*

A Starling Roost in the Chicago Area.—The Starling (*Sturnus vulgaris*) is soon to be one of the common birds of the Middle West, if their rapid spread in the Chicago area is any indication. The first large roost in the region, so far as I know, is one at Homewood, Illinois. Mr. C. J. Albrecht reported to me that flock after flock of Starlings passed his house each evening, enroute to their resting places. On August 17, I saw a few of the birds, but was too late to witness the big flight, so we walked a couple of hundred yards from Mr. Albrecht's home, to that of Mr. Charles Harmke. The chatter of congregated birds was evident when we were 100 yards away, and we found great numbers of Starlings, Robins,

Grackles, English Sparrows, and a few Purple Martins swarming into the box-elders, cotonwoods, willows, and maples. Whenever we clapped our hands the birds would rise in flocks of twenty to one hundred. To be conservative, we estimated that there were 1,000 Starlings, but there were probably a great many more. Mr. Harmke said that the birds had been using the trees for their roosts for three years, and were such a nuisance with their filth that he believed he would destroy the trees.—Alfred M. Bailey, *Chicago, Ill.*

A Large Fall Migration of the White Pelican.—While riding around the south side of Crystal Lake, Dakota County, Nebraska, about 3:00 P. M. on October 4, 1931, my attention was called to a large flock of birds. At first we were undecided as to what they were. They were circling slowly, and as they came closer we decided that they were pelicans, and the size of the flock seemed to indicate the largest one of migrating pelicans that we had ever noticed.

There were four in the party and we tried counting them to form an estimate. They were widely scattered and we could count the small detached bunches. The count ranged from 700 to 1,200, and we compromised at 900. This flock was followed by several others. The one immediately following contained about half as many and four others followed in the next hour and a half, numbering from about 150 to 400. They were all flying slowly to the southeast, down the Missouri River Valley.

After watching these birds for some time we drove to the ranch house of Elmer Ebel, who has lived on this edge of the lake for thirty-three years, and is a close observer of waterfowl, being a conservationist as well as a hunter. He stated that this migration is not uncommon, in fact the pelicans are the first of the migrating birds to go south, and he has seen them in much greater numbers than on this occasion. The migration of these birds extends over a period of two weeks.

Mr. Ebel's father, the late Henry Ebel, lived on this land since 1868 and told the story that is also related by his son, of the pelicans alighting on this lake, spreading clear across it, and swimming along in one direction to some shallow place and apparently driving the fish to the shore, where they scooped them up with their great bills.

One week later, on October 11, 1931, Mr. Ebel reported a flock of eighteen pelicans resting on a sand-bar in the Missouri River, which is but a mile and a half distant from Crystal Lake.—W. R. Felton, *Sioux City, Iowa.*

Notes on the Nesting of the Bronzed Grackle and Say's Phoebe.—In July, 1929, I watched several pairs of Bronzed Grackles (*Quiscalus quiscula aeneus*) attending to nesting duties, at Scranton, in southwestern North Dakota. The birds had built their nests on the steel beams inside of a large coal briquet plant, which was not in operation at the time. The grackles seemed much at home and resented our intrusion.

Several years ago I found the nest of a Say's Phoebe (*Sayornis sayus*), at Tuttle, South Dakota, about eighteen miles west of the Missouri River and near the North Dakota boundary line. The nest was placed over a window in an abandoned railroad station and contained four eggs at the time. Dr. W. J. Hoffman, Acting Surgeon, U. S. Army, observed a few Say's Phoebes in this region in 1873, while stationed at the Grand River Agency.—William Youngworth, *Sioux City, Iowa.*

Some Notes on Birds for 1930.—The first migrant Nighthawk (*Chordeiles minor minor*) was seen August 25. From this date until the latter part of September several were seen every evening and from then on until October 13, flocks of hundreds were seen at dusk. Of late years the main fall migration route has been a little to the east. The spring route is unknown.

The fall migration was very marked in the entire absence of the Hermit Thrush (*Hylocichla guttata faxoni*) and a few only of the Olive-backed Thrush (*Hylocihla ustulata swainsoni*) on September 1 to 3. Both generally are common migrants and stay several weeks.

On September 18 there was a migration of female Rose-breasted Grosbeaks (*Hedymeles ludovicianus*) that continued for a couple of days.

On September 23, there was a migration of Catbirds (*Dumetella carolinensis*) that continued for two weeks. This was the first time that I have ever noticed an increase in the species during migration.

Instead of the usual increase in Cardinals (*Richmondena cardinalis cardinalis*) during the winter season, there was a marked decrease, very few remaining here this winter.—Katie M. Roads, *Hillsboro, Ohio.*

Influence of an Osprey on Bronzed Grackles and Pied-billed Grebes.—On September 26, 1931, while the writer was watching three Pied-billed Grebes (*Podilymbus podiceps podiceps*) on the artificial lake in Glen Helen, Antioch College campus, Yellow Springs, Ohio, an Osprey (*Pandion haliaetus carolinensis*) flew over the water. At the time there were six to eight hundred Bronzed Grackles (*Quiscalus quiscula aeneus*) in the oaks along the east side of the four-acre lake. About one-third of these pursued the Osprey which circled the lake twice before "climbing" higher into the air where the wind was much stronger. I believe that the grackles became discouraged and quit the pursuit because of the stronger velocity of the chill wind at the higher altitude. Before the grackles saw the Osprey they were comparatively quiet. For a half hour after the pursuit of the Osprey began and ended they kept up a veritable din by their noisy "squeaking". As soon as the Osprey was gone I looked for the grebes. They had swum inshore and were taking cover in a small patch of half-submerged rushes, where they remained for twenty minutes or more. Previous to the Osprey's appearance they had been feeding, probably on fresh-water snails, in the clearer water near the entrance of the stream which fills the lake.—Louis B. Kalter, *Dayton, Ohio.*

Notes on the Feeding of the Least Bittern.—On September 5, 1931, a Least Bittern (*Ixobrychus exilis*) stood on the edge of the mud at the margin of the shallow water of an upper pool of a water supply reservoir in Butler County, Pennsylvania, where water plants and cat-tails grow in islands and clumps. When first seen, it was standing very still with the head drawn in toward the body somewhat, and the long bill parallel to the water surface. As I watched, it slowly raised one foot and put it down in the water with extreme care. There was almost no ripple on the water as the bird advanced for about eighteen inches, making no movement except that of the feet. Then the head and neck shot forward, the bill pierced the surface of the water and a four-inch fish was captured by the bill grabbing it in the center of the body. The bittern turned toward the shore and walked rapidly out of the water holding the bill with the fish pointing skyward. On shore, the fish was eaten while the tail feathers of the bird wiggled very much like the wagging of the tail of a contented dog.—Sidney K. Eastwood, *Pittsburgh, Pa.*

Recent Bird Notes from Southern South Dakota.—On July 7, 1931, the writer had occasion to spend the day in Yankton County, South Dakota, a distance of about sixty-five miles northwest from Sioux City, Iowa. The following notes taken there are thought worthy of mention. A male Rocky Mountain Grosbeak (*Hedymeles melanocephalus papago*) was seen carrying food, and was no doubt a breeding bird. This must be about the extreme eastern limit of this western grosbeak. The Western Blue Grosbeak (*Guiraca caerulea interfusa*) was not uncommon in suitable habitats. Several Rock Wrens (*Salpinctes obsoletus obsoletus*) were also seen and heard along the cliffs, on which hundreds of Cliff Swallows (*Petrochelidon lunifrons lunifrons*) had plastered their nests. An interesting overlapping of breeding ranges was also found. The Eastern Towhee (*Pipilo erythropthalmus erythropthalmus*) was found breeding, and the more western form, the Aretic Towhee (*Pipilo maculatus arcticus*), was also not uncommon. The call notes of the latter bird are very distinct from those of the eastern form. The Ovenbird (*Seiurus aurocapillus*) was found along the Missouri River bottoms, and on the uplands the families of the Lark Sparrow (*Chondestes grammacus* subsp.) were already forming into flocks of forty or fifty birds.—William Youngworth, *Sioux City, Iowa.*

A Large Flock of Wood Ibises in Harrison County, Iowa.—On the morning of September 9, 1931, while I was approaching the village of Mondamin, Harrison County, Iowa, from the south, I saw a flock of at least two hundred Wood Ibises (*Mycteria americana*), which had apparently just taken flight from along the Missouri River. The exact site where the birds were first seen was one-half mile from the village. They rose in two groups, which later joined to form the one large flock. As they wheeled about in great circles, rising apparently to gain the advantage of a strong wind, they made a spectacular and beautiful display, with brilliant white breasts flashing light in unison as the birds turned again and again. I had a splendid opportunity to observe them through glasses, and at reasonable range, and even tried to secure a photograph by getting into a position in advance of the flock, but in so doing the birds were lost from sight. They were last seen wheeling about very high in the air and traveling northeastward, about five miles northeast of Mondamin. I was surprised to encounter these birds, with which I have been familiar in Florida, under tthe circumstances mentioned. I believe this is the first Iowa record of the species.—Wallace B. Grange. *U. S. Biological Survey, Washington, D. C.*

White-breasted Nuthatches Occupy a Nest Box.—For the past twenty years I have been interested in attracting birds to nest boxes at my farm near Atlantic, Iowa. In that time Flickers, Red-headed Woodpeekers, Screech Owls, Sparrow Hawks, Bluebirds, Chickadees, House Wrens and Purple Martins have reared their families in boxes which I have put up for them. In another location a pair of Crested Flycatchers did likewise. The past summer (1931) added another box nester to the list, the White-breasted Nuthatch, which is common in my grove.

The box used by the nuthatch was similar to those put up for woodpeckers, as described in the book, "Birds of the Wild", and was really intended for the Downy Woodpecker. The box was placed about ten feet from the ground and nailed to the side of an elm tree near the garage. The entrance hole was about an inch in diameter, and the cavity of the box was about four and one-half

inches square by ten inches deep, as nearly as I recall. There was a small amount of ground cork placed in the bottom of the cavity, a substance that I have always used when trying to attract woodpeckers.—Frank C. Pellett, *Hamilton, Ill.*

The Red-Cockaded Woodpecker in Grundy County, Tennessee.—On August 8, 1931, Mr. Eugene Odum of Chapel Hill, North Carolina, and I took a trip to Beersheba, Tennessee, in the Cumberland Mountains, to see if the Duck Hawks and Golden Eagles were in that vicinity during the late summer.

While walking along the bluffs, which overlook the deep gorge of Roaring Fork, and which are covered with pines, spruces and second growth hardwoods, we heard some unusual bird calls at a point about half way between Beersheba and Stone Door Cliff. These calls seemed to come from woodpeckers or nuthatches, but were quite different from any calls either of us had ever heard before. The birds resembled Hairy Woodpeckers save for stripes across their backs and the noisy calls which parents and three young kept making constantly. Being uncertain as to their identity, we waited until our return to Nashville for a decision. The size, color, calls, habits, and habitats proved them to be the Red-cockaded Woodpeckers (*Dryobates borealis*), a species new to both of us.

Further investigation shows that Dr. Harry Fortner of the University of Tennessee reported them to Mr. A. F. Ganier some six or eight years ago from Beersheba; that Mr. S. N. Rhoads found them in 1895 near Jamestown, Tennessee, in a similar habitat; and also that Fox took a specimen at Rockwood, Tennessee, April 4, 1884. Since these are the only records for this species in Tennessee it is evident that *Dryobates borealis* is a very rare bird in this latitude west of the Alleghanies.—George R. Mayfield, *Nashville, Tenn.*

The Red-headed Woodpecker as a Mouser.—The streets past my home are paved with smooth unbroken concrete slabs, twenty-four feet wide, with a curbstone six inches high at the sides. Just across the street is a school grove consisting of many fine old shade trees. Robins, Blue Jays, Red-headed Woodpeckers, and several other species make their home in this grove.

On the afternoon of July 28, 1931, I noticed a mouse (*Mus domesticus*) running on the pavement. What could have caused this little creature to come out in broad daylight and parade on the pavement I could not tell, but it had not gone very far when a Red-headed Woodpecker (*Melanerpes erythrocephalus*) darted down out of the grove and made an attack upon it. The woodpecker struck the mouse several hard and vicious blows with its stout bill, rolling and tossing it over and over. It appeared that a moment more of such treatment must have finished the mouse, had not a vehicle approached just at that instant, threatening to crush both the red-head and its prey. The bird darted away just in time to save itself, and the mouse, not having been struck by the wheels, hurriedly limped to the edge of the pavement, got over the curb with difficulty, and hid in the grass. The red-head flew back immediately to see what had become of its prospect for dinner, but the mouse was so well hidden that the bird had to give up the chase.

This bird is somewhat erratic in its migrations, but is usually to be found here in fair numbers in the summer time. Ordinarily it catches and devours great numbers of cicadas, June-beetles, grasshoppers, dragonflies, and many other insects, both large and small, but although I have carefully observed it for many years, I had never before seen it attack a rodent.—E. D. Nauman, *Sigourney, Iowa.*

The Blue-Gray Gnatcatcher in Indiana.—I noticed in the Wilson Bulletin for September, 1931, p. 230, that Margaret L. Weir of Hawarden, Iowa, says concerning the Blue-gray Gnatcatcher (*Polioptila caerulea caerulea*) that she found its nest hanging in the fork of a branch some twenty-six feet over the sidewalk. I have had some experience with this interesting bird, but it had a very different nest from the one she described. I did not know the Blue-gray Gnatcatcher ever built anything except the one kind of nest, and that one similar to but larger than the nest of the Ruby-throated Hummingbird. A nest that we found this summer was on top of a dead limb of a tree, where the branch forked with one above the other, and this nest was built upon the lower branch so that the other fork was a sort of a protection over the nest.

When we first noticed the bird it was fighting two Hairy Woodpeekers which were in the same tree. Then it flew immediately to the nest with an insect or worm for the young, making it easy to see the nest. We watched for some time, noting how suitably the nest was placed and how well it was built. It was about twenty feet from the ground near the river in Mounds State Park, which is about three miles from this place. A few days later we returned to the place to find the three young birds out in the tree, begging for food and following the parents about to be fed. Later we went to try to get the nest and found that it had disappeared. We hunted for it on the ground but it was gone. It was perfectly made and about four inches deep, covered with lichens. Several pairs of these tiny birds were in the same park during the summer, indicating they were nesting thereabouts.—Mrs. Horace P. Cook, *Anderson, Ind.*

Unusual Nesting Site of Chimney Swifts.—April 1, 1930, found me badly in need of some Senega Snakeroot (*Polygala senega*) plants, a plant bearing a root that is much used in medicine, so early that morning I set forth with a companion in quest of some. We finally found some on a southern hillside overlooking the rocky, winding stream of Bullfork, a small creek northeast of my home. But we did not work long, for a sudden rain forced us to seek shelter. About a quarter of a mile from us on the opposite side of the hill was an old unused log house, and my companion and I hastened to reach it before we became wet, but as the rain gained steadily in volume we were forced to give up the idea of collecting more plants.

We ate our lunch, and, becoming tired of inactivity, began to explore the old house. The ceiling was little higher than the height of an average man, and the attic was reached through a square hole cut in one corner of the ceiling. I climbed through this, and after becoming accustomed to the poor light, the first thing I noted was a row of seven nests of the Chimney Swift (*Chaetura pelagica*) plastered to the southern wall, about three feet beneath the comb. The three middle nests were built complete to the last stick, but two nests on either side of the completed three were but half finished. The nests were straight in line, spaced almost alike. I should say that they averaged about eight inches apart. Cracks in the walls of the attic allowed about half light to enter, but the only way that the swifts could have entered was through one eight-inch tile set in the roof, a tile that had once served as a "collar" for a stove pipe that had come from a stove in the lower room through a hole in the attic floor, and then through the tile in the roof to the outside.

I wondered if one pair of swifts had built the seven nests, and went back later in the spring to see if I could learn, but some one had partly demolished the

old building so, of course, the swifts were not there. However, a pair of Phoebes (*Sayornis phoebe*) were using a nest that I had seen on my first trip, a many-storied nest above the north window of the downstairs room.—Grant Henderson, *Greensburg, Ind.*

Some Observations on the Eastern Willet at Nesting Time.—The nest of the Eastern Willet (*Catoptrophorus semipalmatus semipalmatus*), its notes and migrations, have been quite well covered, but little seems to have been written about the nesting habits and period of incubation.

I had the opportunity during April and part of May, 1931, to spend a part of the time along a sandy fill where these birds nest abundantly, but unluckily had to leave before completing the season with them. The Long Island Fill and the connected Oysterbed Island are in the neighborhood of the Georgia-South Carolina state line, and on the north side of the Savannah River, near the entrance, and looking out toward Callibogue Sound and the open sea. The willets feed on the extensive mudflats and nest in the thick Bermuda grass on the higher sandy ground.

The nests show the individuality of the pair, though always scanty as nests go, as sometimes eggs are laid on the ground and very little grass is added during the incubation. Others prepare a nest before laying the eggs, and while some use dry grasses only, others include some green material. In all, eleven nests were logged and visited from day to day as eggs were added. No attempt was made to set up a blind near the nests. The presence of the birds was noted with reference to the time of day, and of tides, and it was found that the eggs were seldom uncovered for more than a few minutes at a time, after incubation had commenced, which was as soon as the last egg was laid. One exception to this concerned a nest which could be found uncovered quite often, and it later seemed that only one bird was caring for the hatching. Whether this was a case of desertion or accident, of course cannot be told, but if this nest alone had been relied on, some very different, and erroneous conclusions might have been reached.

Both birds incubate. They change at quite frequent intervals, though flushing the bird from the nest may have been the reason. To determine this, a small swab covered with prussian blue in oil, in once case, and with smeary maroon paint in another, was placed in the nest. One pair appeared with maroon paint on the wing of one and the belly of the other. The second pair had one unmarked bird, and one with a large blue area underneath. Several times I flushed one bird, and a half hour later found its mate on the eggs. The feeding grounds are so near that usually both birds are near, or within call.

In a couple of cases the birds would allow close approach, before leaving the eggs. One, in particular, would sometimes stay until I parted the grasses directly overhead. The eggs are laid at one or two day intervals, varying with different pairs, and until the full clutch is laid are not covered at all times. The temperature and protective coloring probably makes covering unnecessary.

After leaving the vicinity, I made a trip back, and found two young birds in the nest. The clutch had been completed on May 6 or 7, and this was the 30th, which gives an incubation period of twenty-three or twenty-four days. These two young had been hatched not much over an hour, yet one persisted in trying to crawl into the surrounding grass. The young birds are seldom seen from the time of hatching until the flight feathers are partly grown, when they begin picking up food along the sand and the mudflat edges.

After the nesting season the willets are shy and retiring, not nearly so conspicuous as the yellowlegs, until the next spring, when they become one of the noisiest birds of this locality, often crying all night long, as well as in the day.

During the winter months there are a few Western Willets (*Catoptrophorus semipalmatus inornatus*) mixed with the few Eastern Willets present. I have never been able to identify them in the field, but the larger size and longer bill of the western bird is plainly apparent when in the hand.

The willets of this coast have certainly been increasing during the last few years, for where there were two or three pairs in 1923, now there are at least twenty pairs. On April 26, 1931, a few miles to the southward, a flock of twenty migrating birds was seen. At this time most of the locally breeding birds were already mated.—Ivan R. Tomkins, *Savannah, Ga.*

Additional Bird Records for South Dakota.—The manuscript for Bulletin No. 9, Birds of South Dakota, passed from the authors to the Department of Publications of the University of South Dakota during the winter of 1916. Due to the stress of the war period and to lack of funds, it was not published until March, 1921. The authors had no control over these circumstances, and during this interval did not have access to the manuscript. But from 1916 to the present we have made many corrections and revisions, and have added twenty-nine species and subspecies to the former list.

It seems necessary because of lack of authentic records to eliminate Bonaparte's Gull and the Greater Snow Goose from the list, leaving a total of 320 in the old list, or, with the new additions, a total of 349 species and subspecies for the state. It is not practicable to publish a new, revised edition at this time, hence we are submitting the new records. The University Museum has acted as a clearing house, and is grateful to the many observers over the state for assistance rendered in keeping the records, as far as known, up to date.

American Egret (*Casmerodius albus egretta*). A straggler. Authentically identified on June 4, 1929, by W. F. Kubichek, of Coe College at Cedar Rapids, Iowa. This bird was with a colony of Black-crowned Night Herons on a wooded island in Rush Lake, Day County. (See note by Youngworth, Wilson Bulletin, XLIII, December, 1931, p. 309).

Little Blue Heron (*Florida caerulea caerulea*). A straggler. One seen by W. H. Over and H. Rice in Clay County, June 11, 1921. Later seen by L. G. Atherton of Flandreau.

White Ibis (*Guara alba*). An old record, of about 1890, but one was repeatedly seen during that summer at a small lake in the northern part of Clay County by Dr. G. S. Agersborg and Fred Heglin. Dr. Agersborg was the first resident bird student of note in South Dakota, and published a list of birds of Clay and Yankton Counties in the *Auk* in 1885.

White-winged Scoter (*Melanitta deglandi*). Rare in migration. Taken on Lake Madison, Lake County, by J. C. Green of Sioux Falls. Specimen now in the University Museum.

White-rumped Sandpiper (*Pisobia fuscicollis*). Fairly common in migration. Specimens taken in Sanborn County are in the Museum.

Western Sandpiper (*Ereunetes maurii*). Common some years in migration. Skins are in the Museum that were taken in Lyman County, April 13, 1928, by Walter Thietje.

Red Phalarope (*Phalaropus fulicarius*). Fairly common in migration up the eastern side of the state. Skins in the Museum.

Broad-tailed Hummingbird (*Selasphorus platycercus platycercus*). In "Birds of the Northwest", by Elliott Coues (1874), two records are mentioned for the Black Hills. Mr. C. H. Holden, a correspondent of Dr. Coues, reports a nest. Its range is probably on the western slope of the Hills, but the writers have never seen a specimen in the Black Hills.

Northern Crested Flycatcher (*Myiarchus crinitus boreus*). Reported as nesting in Yankton County by Dr. A. P. Larrabee of Yankton College, and in Minnehaha County by C. J. Stringham, who sent the hollow limb and nest to the Museum.

Acadian Flycatcher (*Empidonax virescens*). Reported by T. C. Stephens for June 2, 1918, in "A Preliminary List for Union County" in the Proceedings of the Iowa Academy of Science, XXV. Minnehaha County, 1920, C. J. Stringham. Probably nests sparingly in the southeast corner of the state.

Hoyt's Horned Lark (*Otocoris alpestris hoyti*). Probably our most common winter visitor.

Rocky Mountain Nuthatch (*Sitta carolinensis nelsoni*). Listed from Elk Creek, Black Hills, under the name of Slender-billed Nuthatch (*S. c. aculeata*), by George Bird Grinnell (Report of a Reconnaissance of the Black Hills, by William Ludlow, Captain of Engineers, U. S. Army, Washington, D. C., 1875), prior to the separation of *nelsoni* as a subspecies distinct from *S. c. aculeata* of the west coast region.

Carolina Wren (*Thryothorus ludovicianus ludovicianus*). A straggler. Yankton County, 1929, A. P. Larrabee.

Blue-gray Gnatcatcher (*Polioptila caerulea caerulea*). Minnehaha County, 1920, C. J. Stringham. Faulk County, 1924, Mrs. C. M. Norton. Probably a rare summer resident as it has nested across the Big Sioux River at Hawarden, Iowa, 1931. See the report by Margaret L. Weir in the Wilson Bulletin, Vol. XLIII, 1931, page 230.

Yellow-throated Vireo (*Vireo flavifrons*). A migrant. Yankton County, 1921, A. P. Larrabee of Yankton College.

Blue-headed Vireo (*Vireo solitarius solitarius*). Minnehaha County, 1920, C. J. Stringham. Yankton County, 1921, A. P. Larrabee.

Prothonotary Warbler (*Protonotaria citrea*). A migrant. Clay County, May 22, 1926, E. P. Churchill and W. H. Over. Union County, May 12, 1929, W. F. Kubichek.

Northern Parula Warbler (*Compsothlypis americana pusilla*). A migrant. Minnehaha County, 1920, C. J. Stringham. Yankton County, 1921, A. P. Larrabee.

Cape May Warbler (*Dendroica tigrina*). A migrant. Clay County, May 17, 1920, W. H. Over and W. M. Davidson, and many times later.

Black-throated Blue Warbler (*Dendroica caerulescens caerulescens*). A migrant. Minnehaha County, 1920, C. J. Stringham, A. Schaeffer, Adrian Larson. Faulk County, Mrs. C. M. Norton.

Cerulean Warbler (*Dendroica cerulea*). A migrant. Minnehaha County, 1920, C. J. Stringham. Faulk County, Mrs. C. M. Norton .

Black-throated Green Warbler (*Dendroica virens virens*). A migrant. Union County, 1931, William Youngworth (see the Wilson Bulletin, XLIII, No. 3, p. 223).

Northern Pine Warbler (*Dendroica pinus pinus*). Dr. Charles E. McChesney (Notes on the Birds of Fort Sisseton, Dakota Territory, United States Geological Survey, Bulletin No. 5) reports as follows for this species: "Is seen in small numbers only, from May 22 until about the first of June each year; does not breed on the *Coteau des Prairies* to my knowledge."

Connecticut Warbler (*Oporornis agilis*). A migrant. Minnehaha County, 1921, C. J. Stringham. Spink County, 1931, J. F. Brenekle.

Canada Warbler (*Wilsonia canadensis*). Dr. Charles E. McChesney (Notes on the Birds of Fort Sisseton, Dakota Territory) says: "This warbler arrives by the 22nd of May, and is seen in some numbers for a few days, but appears to depart by the 1st of June, as I have never observed it after that date."

Gray-crowned Rosy Finch (*Leucosticte tephrocotis tephrocotis*). Frequent winter visitor in the Black Hills. W. H. Over, November, 1921. Often fed during the winter by W. J. Sharwood of Deadwood, Laurence County.

Hepburn's Rosy Finch (*Leucosticte tephrocotis littoralis*). Stragglers have been seen with the typical form of the species during the winter in the Black Hills by W. J. Sharwood of Deadwood, Laurence County.

Bendire's Crossbill (*Loxia curvirostra bendirei*). Black Hills, October 16, 1903, Merritt Cary. McPherson County, July 29, 1931, Clarence Cottam of the United States Biological Survey. (See the Wilson Bulletin, XLIII, 1931, page 311, "Some New Bird Records for South Dakota", by Mr. Cottam).

Swamp Sparrow (*Melospiza georgiana*). A summer resident. In the list of birds seen, Lieutenant G. K. Warren (A Preliminary Report of Explorations in Nebraska and Dakota, by F. V. Hayden: War Department Annual Report for 1858) records the Swamp Sparrow from the mouth of the Vermilion River (now Clay County) in 1857. Specimens in the Museum taken by F. A. Patton in Sandborn County in 1921.—William H. Over and Craig S. Thoms, *Vermilion, S. D.*

PROCEEDINGS OF WILSON ORNITHOLOGICAL CLUB

By Jesse M. Shaver, Former Secretary

The Eighteenth Annual Meeting of the Wilson Ornithological Club was held at New Orleans, Louisiana, on December 26-29, 1931, in connection with the general sessions of the American Association for the Advancement of Science. Saturday and Sunday (December 26 and 27), the Wilson Club made an excursion to Avery Island for the purpose of studying water birds. Here, Honorable E. A. McIlhenny entertained in true southern fashion. It was a memorable trip, especially for our members from the north. Each one will long remember the view of Snowy Egrets coming to roost in the marsh at twilight. There also remains the remembrance of a kindly, portly gentleman who, as our host, taught us the real meaning of southern hospitality. It is thus that we remember E. A. McIlhenny.

Monday and the morning of Tuesday were given to the reading of papers by our members and to a brief business meeting. These meetings were held in Gibson Hall, Tulane University.

Since President Stack was absent due to illness, Secretary Shaver called the meeting to order and called for nominations for a temporary chairman. Lynds Jones was elected and presided over the rest of the sessions.

Tuesday afternoon was given over to the presentation of moving pictures with some business being considered. The Annual Dinner was held on Tuesday evening, December 29, in the Evangeline Room of Hotel De Soto (our headquarters hotel).

Business Sessions

The business sessions were held on Monday from 9:20 to 10:00 A. M., and interspersed between the moving pictures of Tuesday afternoon's session.

At the Monday morning business meeting, the minutes of the previous meeting were approved without being read, since they had previously been published in the Wilson Bulletin (Vol. XLIII, No. 1, pages 66-86). The Secretary's report was regarded as satisfactory under existing financial conditions. It showed a total membership of 756 with 131 delinquent members. The Editor reported on a number of details touching the Wilson Bulletin. Exact figures on subscribers and exchanges were not given since the report was given extemporaneously. The full report of the Editor as well as that of the other officers will be found in this number of the Bulletin. The Treasurer's report was read, in the absence of the Treasurer, by T. C. Stephens. It was referred to the Auditing Committee for consideration. All new members temporarily elected by the Electoral Board were approved. T. C. Stephens read the report of F. P. Allen, Librarian, bringing up certain matters pertaining to the Library of the Wilson Ornithological Club. On motion made by A. F. Ganier, seconded, and passed, these matters were referred to the Executive Council for consideration and action. Lynds Jones made a report supplementary to that of the Library Committee indicating that a sample reproduction of an out-of-print number of the Wilson Bulletin had been made at a cost of $18.75. A motion to authorize the Treasurer to pay this amount was unanimously passed. The temporary committees appointed at this time were: the Committee on Nominations, the Committee on Resolutions, and the Auditing Committee.

The Committee on Nominations was composed of Mrs. H. J. Taylor, T. C. Stephens, and Paul R. Elliott. The Committee on Resolutions was composed of

A. F. Ganier, Glenn W. Bell, and Fannye Cook. Josselyn Van Tyne and W. D. Johnson were appointed on the Auditing Committee.

At the Tuesday afternoon session, all committees reported.

The report of the Committee on Nominations was accepted and, on motion, the Secretary was instructed to cast one ballot for the slate. The new officers thus elected were:

President: Jesse M. Shaver, George Peabody College for Teachers, Nashville, Tennessee.

First Vice-President: E. L. Moseley, State Teachers College, Bowling Green, Ohio.

Second Vice-President: Josselyn Van Tyne, University of Michigan, Ann Arbor, Michigan.

Secretary: Lawrence E. Hicks, Ohio State University, Columbus, Ohio.

Treasurer: W. M. Rosene, Ogden, Iowa.

Councillors:

A. F. Ganier, Nashville, Tennessee.

Lynds Jones, Oberlin, Ohio.

Myron H. Swenk, University of Nebraska, Lincoln, Nebraska.

The Committee on Resolutions made the following report which was unanimously adopted:

Resolved, The Wilson Ornithological Club, assembled for its eighteenth annual meeting at New Orleans, Louisiana, this 29th day of December, 1931, wishes to record its thanks and appreciation to:

Tulane University, for the use of its buildings and equipment, so well adapted to our meetings:

To our fellow-member, Edward Avery Mellhenny, for his courtesies and hospitality in entertaining the Club at New Iberia and on his estate at Avery Island, to view the unique plant life of the locality and the large assemblage of water and other birds wintering there;

To our local members and constituents in the New Orleans district, who by their interest and assistance, have helped to make this meeting a success;

To our efficient officers, particularly to Secretary Shaver, Editor Stephens, and Treasurer Rosene, who by so generously giving of their time and interest to the Club, have enabled it to continue the high standards set in the past.

Whereas, our National Bird, the Bald Eagle, has become so rare within the interior of our country that its complete extermination is threatened and that

Whereas, those which reside upon our seacoasts subsist almost entirely upon fish and therefore do little or no harm to the property of man, therefore be it

Resolved, that The Wilson Ornithological Club earnestly advocates that legislation be enacted which will bring about the complete protection of the Bald Eagle within the United States.

Whereas, The Wilson Ornithological Club is interested in the conservation of all forms of wild life;

And Whereas, The Protective laws for grizzly and brown bears of Alaska have been largely removed; *And Whereas*, they are in danger of extermination due to encroachment of industry, including the Paper Pulp Mills proposed for Admiralty and Chicagof Islands:

And Whereas, these Islands have, it is estimated, over half the grizzly and brown bear population of Alaska; be it

Resolved, that the Biological Survey and the Alaska Game Commission reenact adequate protective laws for the Alaska bears generally; and be it further

Resolved, that the Admiralty and Chicagof Islands be established as permanent preserves or national parks for the protection of the Alaska grizzly bears; be it further

Resolved, that copies of this Resolution be sent to Members of Congress, The Biological Survey, The Alaska Game Commission, and Special Senate Committee on wild life resources.

The Auditing Committee reported that the Treasurer's accounts were well kept, accurate, and balanced. The Committee's report was accepted and the Treasurer's report approved.

At the close of the Tuesday afternoon program, the Acting President, Lynds Jones, declared the meeting adjourned.

Social Features

The entertainment of the Club at Avery Island by Mr. E. A. McIlhenny was by far the outstanding social event of the meeting. Mr. McIlhenny is a most gracious host who plans everything for the comfort of his guests, even to the minutest detail.

The Annual Dinner was held Tuesday evening, December 29, in the Evangeline Room of the DeSoto Hotel. The dinner was a great success in every way. An attractive menu was served. Dr. John McBryde of Tulane University, served as Toastmaster, introducing each of the speakers in his usual charming manner. The following toasts were on the program:

Looking Backwards. Lynds Jones.

Looking Forwards. Mrs. H. J. Taylor.

The Wilson Bulletin. T. C. Stephens.

A Backward Glance at the History of the National Association of Audubon Societies. T. Gilbert Pearson.

At noon on both Monday and Tuesday, the members had the pleasure of lunching together in the dining room in Gibson Hall.

Exhibits

No special exhibits were arranged for this meeting of the Wilson Ornithological Club. However, Mr. Hopkins of the Louisiana State Department of Conservation, kindly invited our members to visit the Conservation Museum where many interesting exhibits were arranged. Mr. Frank Carroll also kindly invited members to visit his own personal collections.

Program of Papers

The program is given below just as it was carried out, which varies slightly from the order in which it was announced in the program printed for the meeting.

Monday Morning, December 28, 1931

Mr. Stanley C. Arthur welcomed the Wilson Club to New Orleans in a few well-chosen words. The response on behalf of the Club was made by Dr. Lynds Jones.

1. Observations from a Ninety by Two Hundred and Eight Foot Town Lot. Mrs. Elizabeth Allen Satterthwait, Webster Groves, Mo.

   Over a period of thirteen years, with sometimes a break of several weeks' absence from home, bird observations have been made from an improved city lot, 90′x208′, in Webster Groves, Missouri, and 102 species and varieties have been recorded. Observations have been made of a few unusual species, in-

cluding the European Tree Sparrow (found in the United States only in the vicinity of St. Louis). Six different thrushes have been banded, and notes made regarding the banding, feeding and measuring of approximately forty species.

2. Notes on the Birds of the Campus of The Berry School for Boys. (Lantern.) Glenn W. Bell, The Berry School for Boys, Mount Berry, Ga.

This study was carried on from September 6, until May 6, in each of the school years of 1928-1929, 1929-1930, and 1930-1931, respectively. The study was made at different intervals during the day. In the spring time, the early morning was chosen for the study of the nesting activities of the birds.

A feeding station attracted many birds. Over a thousand individual birds were captured and banded with the United States Biological Survey bands. In addition to the aluminum bands, colored celluloid bands were used on a few birds. Notes were kept on the various birds seen on the campus.

Maps were made of the campus, and each bird's nest was indicated on the maps. There were few nests destroyed. Bluebird nests increased when nesting boxes were provided. There were about the same number of the other birds nesting on the campus during each of the three years. In many cases the nests were near the nesting sites of the preceding year.

3. Ornithological Exploration in British Honduras. (Lantern.) Josselyn Van Tyne, University of Michigan, Ann Arbor, Michigan.

The speaker gave an account of the work of an expedition from the University of Michigan Museum of Zoology which in February and March, 1931, penetrated to the little known "Southern Pine Ridge" south of El Cayo, British Honduras. The "Pine Ridge" is an area of savannah and pine forest very similar in appearance to those of Georgia and Florida. Although at 17° N. latitude and an altitude of less than fifteen hundred feet, the pine forest is sharply demarked from the surrounding rain-forest jungle and has a very distinctive avifauna. Characteristic birds of the pine ridge were *Balanosphyra formicivora*, *Myiochanes pertinax*, *Pionus senilis*, *Dendroica graciae*, *Aimophila rufescens*, and an hitherto undescribed vireo.

4. The Relation of Temperature and Relative Humidity to the Time of Ending of the Evening Song of Birds. (Lantern.) Paul R. Elliott, Richard Hardy Memorial School, Richard City, Tenn.

This paper is a report of a study made at Nashville, Tennesse, over a period of 147 consecutive days in the spring and summer of 1930, to determine any existing relations between temperature or relative humidity and the time at which the various birds stopped their evening songs. It was found that temperature was highly significant in the case of the Mockingbird, only. Relative humidity was of slight importance, not even being very significant with the Yellow-billed Cuckoo.

5. A Brief Survey of the Bird Life of Baldwin County, Ala. Helen M. Edwards (Mrs. W. H.), Fairhope, Ala.

A brief summary of the outstanding points of interest in the bird life of Baldwin County, Alabama, pointing out the differences between conditions that are found to exist and those that would be expected by a visitor from some other region. No attempt is made to give a complete faunal list, and only those species are named whose occurrence seems to be of particular interest.

6. Nesting of the Golden Eagle in Tennessee. (Lantern.) A. F. Ganier, Nashville, Tenn.

A résumé of the present status of the Golden Eagle in the Southern Appalachians with particular reference to its occurrence at the breeding season in several places in the mountains of Tennessee. An occupied nest, which was discovered in the spring of 1931, was depicted by a number of views.

7. Pioneers in Kansas Ornithology. (Mrs. H. J.) Rose S. Taylor, Berkeley, Cal.

F. H. Snow and Colonel N. S. Goss are pioneers in Kansas Ornithology. Snow's work began when he was called to the University of Kansas which opened its doors September, 1866. Snow's interest in birds continued throughout his life. He published several catalogues of the birds of Kansas. His duties as Professor of the Natural Sciences and later as Chancellor did not allow any one field to absorb him.

Colonel N. S. Goss was an ornithologist from his youth up. He came to Kansas in 1857. He was a successful business man and when he had made a comfortable fortune he devoted his entire time to ornithology. He traveled widely to know birds. He was one of the original members of the A. O. U. and never failed to attend its meetings. His large collection of birds—all his own mounting—he gave to the state in 1881. His book, *History of Birds of Kansas* is the summing up of his life work.

8. The Conservation Policy of the National Association of Audubon Societies. (Lantern.) T. Gilbert Pearson, National Association of Audubon Societies, New York City.

A brief survey of some of the important activities of the National Association of Audubon Societies both in America and foreign countries was presented.

9. The Rhythmical Ending of the Robin's Evening Song in Relation to the Nesting Cycle. (Lantern.) Joe Young West, Baird, Miss. Read, in the absence of the author, by J. M. Shaver.

By means of the Maebeth Illuminometer records were kept of the light intensity in foot candles at the ending of the Robin's evening song during the first two periods of the nesting season (February 17 to June 11, 1931). Records of physiological activities of individual pairs of birds were kept. The data indicate that there is no definite rhythm in the light intensity at the time of the ending of the last evening song of individual Robins in relation to the nesting season. Physiological changes in male Robins relating to the nesting cycle do not influence this specific reaction to light. There is great irregularity in variation of light intensity in foot candles at the ending of the last evening song and this variation is greatest during the establishment of territory.

10. Curvature of Wing and Soaring Flight. (Lantern.) W. B. Taber, Jr., Kansas, Illinois. Read, in the absence of the author, by T. C. Stephens.

This paper explains the mechanics of soaring flight. It is the explanation of the effect of the curvature of the under surface of birds' wings in changing the direction of air currents, thereby producing the forces necessary to overcome gravity and to thrust the bird forward.

11. The Contribution of the Zoöphile to Science. Mrs. Charles Noel Edge, New York City.

Mrs. Edge pointed out the distinctive contribution of scientists who write popular books and papers well, to the advancement of ornithology. The nature-lover may arouse interest in worth-while activities.

12. Observations on the Nesting of the Blue-gray Gnatcatcher. Mrs. Margaret Morse Nice, Columbus, Ohio. Read, in the absence of the author, by Miss Fannye Cook.

The male Blue-gray Gnatcatcher does not sing to proclaim his territory; perhaps the *spee* which is constantly given by both birds serves this purpose. Both male and female labor equally at nest building; during incubation they relieve each other at short intervals (15 to 40 minutes); they carry tiny insects to the young, one by one at a rapid rate. Intense activity and close coöperation between the pair are characteristic of this species.

13. The Relation of Song to the Nesting Season of Birds. (Lantern.) Glenn W. Bell, The Berry School for Boys, Mount Berry, Ga.

This is a study of the relation of song, especially the early morning song, to the progress of the nesting season of birds, in particular that of the Brown Thrasher, Mockingbird, Cardinal, Wood Thrush, Chipping Sparrow, Pine Warbler, and Mourning Dove. The study was carried on from the time the birds began to sing in the spring, until May 6 in each of three years: 1929, 1930, 1931, respectively, on the campus of the Mount Berry School for Boys, Mount Berry, Georgia. The early morning, from the time the birds began to sing until after sun-up, was chosen for the daily period of study. Some additional observations were frequently made during the day, such as: finding nests, locating territories, and observing the general activities of the birds.

The amount and intensity of song was recorded and compared with the nesting activities of the individual bird. Nesting activities seemed to retard the early morning song. When incubation begins, the song is retarded in all species. In most cases, no song was heard early in the morning after incubation began. Therefore, there appears to be a gradual decrease of song as nesting activities progress.

14. The Egg-Laying Cycle of the Mourning Dove. (Lantern.) L. J. Cole, University of Wisconsin, Madison, Wis.

This paper reports the egg-production record of a captive Mourning Dove during five seasons. Most of the time she has been mated with a male Mourning Dove but in 1928 was mated to a domesticated Ring Dove. Her production in the different laying periods has been as follows.

1927:	May 9 to July 25,	16 eggs in	77 days
1928:	March 11 to August 2,	19 eggs in	143 days
1929:	April 19 to August 6,	28 eggs in	108 days
1930:	April 26 to August 16,	24 eggs in	111 days
1931:	April 13 to August 3,	23 eggs in	117 days
Total		110 eggs in	556 days

Fertility with Mourning Dove mate has been good. Eggs were transferred to other birds to hatch and rear. Variability in egg size shows little relation to season, but the second egg of a clutch is usually larger than the first. The sex-ratio for 62 young is 45.2% males (28 males to 34 females). Sex-ratio for first eggs of clutches is 50% males to 50% females; of second eggs, 39% males to 61% females.

15. The Nesting Habits and Growth of the Black Skimmer (*Rynchops nigra*). Frank M. Carroll, New Orleans, La.

Specimens of eggs and all stages from newly-hatched young to adult were shown. Beginning with a description of the adult bird, the various habits and characteristics were outlined after which their method of nesting was considered. The process of incubation was explained and illustrated with embryological specimens. The growth of the chick to maturity was described.

16. Temperature Laws and Life Zones. (Lantern.) S. Charles Kendeigh, The Baldwin Bird Research Laboratory and Western Reserve University, Cleveland, Ohio.

Merriam's Temperature Laws, formulated in 1894, and accepted by many ornithologists, may be criticized upon the following basis: (1) Temperatures at other seasons of the year than the breeding period are important; (2) The mere cartographic agreement between isotherms and boundaries of life zones is without particular significance; (3) The statistical data upon which Merriam based his arguments were incorrectly compiled; (4) The method which was used in summing temperatures is without physiological basis or practical application; and (5) Other phases of temperature or other factors aside from temperature may be the more important.

Experimental studies performed at the Baldwin Research Laboratory indicate that temperature, relative length of day and night, and food supply are

all correlated factors of considerable importance in controlling the distribution, migration, and abundance of birds.

In so far as the life-zone concept is based upon Merriam's Temperature Laws, it is unacceptable. For this concept to survive, it must be based upon the actual distribution of the birds.

17. The Failure of the System in Ecological Work. V. E. Shelford, University of Illinois, Urbana, Ill.

The failure of temperature summing in relation to the development of invertebrates and the lack of accord between life zones and ecological phenomena was stressed. Lack of agreement between communities and life zones was pointed out.

18. Nesting Waterbirds of South Dakota. (16 mm. motion pictures.) W. H. Over, University of South Dakota, Vermillion, S. D.

Interesting moving pictures of the varied water bird life of the lakes of this ornithologically interesting state.

19. Observations on Migrations of Blue Geese and Double-crested Cormorants. (Lantern.) W. F. Kubichek, Coe College, Cedar Rapids, Iowa.

Observations on the migrations of the Double-crested Cormorants, with a chart showing recoveries of bands placed on the birds at Waubay Lake, S. D. Notes on the migration of Blue Geese with special reference to the concentration during the spring migration in the Coteau region of South Dakota

20. The Blue Goose at Avery Island. (35 mm. moving pictures.) E. A. McIlhenny. Avery Island, La.

Showing the almost unbelieveable numbers of Blue Geese concentrated on the Louisiana coast during the winter months.

21. Methods of Bird Study. (35 mm. moving pictures.) S. Prentiss Baldwin and S. Charles Kendeigh, The Baldwin Bird Research Laboratory, Cleveland, Ohio.

Bird-study at the Baldwin Bird Research Laboratory consists of research into the development, life-history, physiology, and ecology of birds. These motion pictures show some of the methods and instruments used in this study.

The growth of the embryo within the shell is the object of special study with the microscope, and motion pictures of this continuous development are being made. Other studies deal with the development of specific gravity of the bird with the expansion of the lungs and air-sacs.

Special interest attaches to the study of body temperatures and the resistance of birds to low and high air temperatures, as this may throw new light on the problem of bird migration, distribution, and abundance.

The temperature of the bird in the nest is obtained, without the bird's awareness, by means of long thermocouples and electrical temperature-recording devices. Other instruments record every visit of the bird to the nest to incubate the eggs or feed the young.

Such studies are yielding much of new interest in the field of ornithological research.

22. The Pelican. (35 mm. motion pictures.) Stanley C. Arthur, New Orleans, La.

The nesting of the Brown Pelican on certain mangrove-overgrown islands at the mouth of the Mississippi River was depicted. The interesting story of the Pelican on the seal of state of Louisiana was revealed also.

23. The Terns at Bird Key, Tortugas Islands, Florida. (35 mm. moving pictures.) J. Paul Visscher, Western Reserve University, Cleveland, Ohio.

Fascinating views of the Noddy and Sooty Terns of Bird Key—made famous by the homing studies of Watson.

24. Feathered Fishers of Our Southland Swamps. (35 mm. moving pictures.) H. L. Stoddard, U. S. Biological Survey, Washington, D. C.

Marvelous pictures of the Egrets, Herons, Wood Ibis, etc., of southern swamps.

25. The Herons and Egrets of Louisiana. (35 mm. moving pictures.) E. A. McIlhenny, Avery Island, Louisiana.

Excellent pictures of the nesting water birds at Avery Island including wonderful views of a nesting colony of Snowy Egrets, and an early film used to combat plume hunting.

26. Present Status of the Nesting Warblers of Tennessee. (Read by Title.) George R. Mayfield, Vanderbilt University, Nashville, Tenn.

This paper discusses the present status of seventeen species of warblers nesting in middle Tennessee and that of five other species nesting in other parts of the state. Four species seem to be on the increase; six seem to be decreasing in numbers; and twelve species are holding their ground. In numbers they range from abundant as in the case of the Maryland Yellow-throat and the chat to rare as in the case of the Swainson's and the Golden-winged Warbler. The Blackburnian Warbler has not been found in Tennessee by any member of the Tennessee Ornithological Society, though reported by earlier observers in Tennessee and in similar habitats in North Carolina. The earliest dates of arrival during the past five years and the latest dates of departure were also given. Records relied on were those of the author with some reference to the lists of others.

27. Sketch: Rim Rock and Solitaire. (Read by Title.) Rev. P. B. Peabody, Topeka, Kans.

A brief survey of the topography of Weston and Crook Counties, Wyoming; of forests; of the psychology of Townsend's Solitaire during the autumn, the winter, and the breeding season. Descriptions of nests, nesting places, and an outstanding set of eggs were given, illustrated by splendid photographs.

REPORT OF THE LIBRARIAN FOR 1931

Ann Arbor, Michigan, December 15, 1931.

I have the honor to present herewith the first report of the Librarian of the Wilson Ornithological Club at the end of the first year of the library's existence.

Housing. The library is housed in a section of the ornithological library of the Museum of Zoology in the new University Museums Building in Ann Arbor. It is shelved apart from the ornithological collection and kept as a distinct and separate entity.

Donors. The Librarian takes pleasure in acknowledging gifts to the Club library from the following:

Mr. Ralph Beebe, Lincoln Park, Michigan.
Mr. Stuart T. Danforth, Porto Rico.
Mr. Ralph E. DeLury, Ottawa, Canada.
Emergency Conservation Committee, New York City.
Mr. Herbert Friedmann, Washington, D. C.
Mr. Lynds Jones, Oberlin, Ohio.
Mrs. F. H. King, Madison, Wisconsin.
Mr. Frank C. Pellett, Hamilton, Illinois.
Mr. John McB. Robertson, Buena Park, California.
Mr. T. C. Stephens, Sioux City, Iowa.
Mr. O. A. Stevens, Fargo, North Dakota.
Mr. E. L. Sumner, Jr., Berkeley, California.
Mr. J. Van Tyne, Ann Arbor, Michigan.

The gifts total 54 bound volumes and 750 separates, many of which are reprints.

Exchanges. With the establishment of the Research Library of the Wilson Ornithological Club the matter of adding to the facilities of the library by the deposition in it of exchanges becomes important. There such serials will be available to all members of the Club. The exchange of the Bulletin for not only domestic but also foreign journals will be of inestimable scientific value to the Club in the field of research. In this field the exchanges may quite naturally become the very backbone of the research library .

Reprinting. The reprinting of out-of-print numbers of the Bulletin is a matter of great importance to the welfare of the Club, and especially to its library. A program of reprinting should be worked out which will eventually make available complete sets of the Bulletin at least from the beginning of the New Series (1894). This will benefit the Club in many ways. A complete set of the Bulletins will aid in facilitating exchanges. It will be much easier to secure a complete set of another society's publications if we have a complete set of our own to offer in return. It will also be of service to the members of the society who are anxious to complete their own sets. There are, doubtless, many members of the Club who have lacunae in their own sets which they have long been waiting to fill. The financial return to the Club from the sale of complete sets should be a considerable item. It should in itself make the matter of reprinting most expedient.

Stock. Dr. Lynds Jones has deposited in the University Museums the entire stock of Bulletins beginning with No. 1 (1894), which is a reprint, to Vol. 36, No. 4 (December, 1924), which is the last number now available in Ann Arbor, the reserve supply from 1925 to date being in Sioux City, Iowa. The supply of Bulletins is housed in the University Museums Building in the fireproof stock room for publications, in dust-proof cases. They are arranged chronologically and labeled. In the Librarian's room there is a card file of the Bulletins where a separate card may be found for each number, indicating the number of copies available.

The Librarian feels that a definite policy should be adopted in regard to the extent of the supply of Bulletins to be kept on hand. A reserve stock of twenty-five numbers should be kept, from which numbers may be taken only to form complete sets. In other words, a number of the Bulletin must be declared to be unavailable when there are but twenty-five copies on the shelves, unless a whole set of the Bulletin is being ordered.

Price. The Librarian suggests that a decided increase in the price of back numbers of the Bulletin be put into effect at once. A minimum price of fifty cents per number is recommended. Some of the early numbers should be sold for not less than one dollar each. The Librarian will be glad to furnish a list of such numbers. It is the custom in many scientific societies to give members of the society the privilege to purchase their society publications at a twenty per cent discount. I recommend this practice to the W. O. C. The Librarian suggests that in each issue of the Bulletin a notice be inserted stating what Bulletins are for sale and the price thereof.

Book Plate. As yet no book plate has been provided by the Club for its books. This should receive the serious attention of the Club.

Respectfully submitted,

F. P. Allen,

Librarian, Wilson Ornithological Club and University Museums.

Fig. 9. J. M. Shaver
President

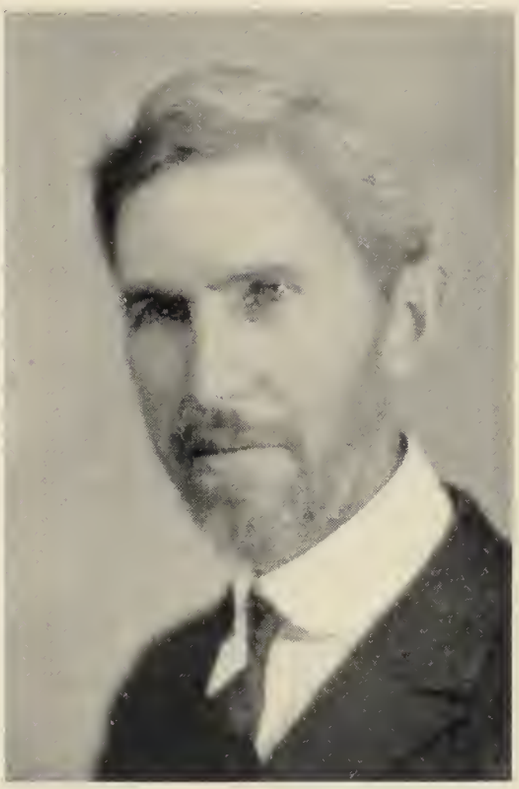

Fig. 10. E. L. Moseley
First Vice-President

Fig. 11. J. Van Tyne
Second Vice-President

Fig. 12. L. E. Hicks
Secretary

Fig. 13. Group at the Annual Meeting, New Orleans, 1931.

REPORT OF THE SECRETARY FOR 1931*

Nashville, Tennessee, December 28, 1931.

To the Officers and Members of the Wilson Ornithological Club:

During the past year, the intensive campaign for new members was continued with even more energy than in 1930, but with results that were not up to the high mark of last year. Altogether about 5,000 circular letters and 2,000 personal letters were sent out from the Secretary's office with only 162 new members secured as compared with 241 last year. These new members were distributed among the different classes as follows: Sustaining, 5; Active, 18; Associate, 139. Although this seems to be a very small per cent of success in solicitation, it should be kept in mind that many of these were follow-up letters after a previous unsuccessful solicitation in 1930, and that many of the letters went to people connected with schools and museums who did not subscribe personally but sent in subscriptions in the name of the school or museum. For instance, all of the members of the Cooper Ornithological Club were re-solicited this year. Shortly afterwards there was a noticeable increase in the number of institutional subscribers from California. In considering this report, it is necessary to remember also the unusual financial conditions of 1931.

At present, the Club has the following paid-up memberships: Honorary Members, 7; Life Members, 7†; Sustaining Members, 57; Active Members, 214; Associate Members, 461; total, 744. Last year the total membership was 776 (which erroneously included eleven members who had earlier resigned). So in spite of the 150 new members secured this year, the Club has suffered a net loss of 24 members distributed as follows: Honorary Members, 0; Life Members, 0; Sustaining Members, 0; Active Members, 10; Associate Members, 14.

Although all records were checked in 1930 by the Editor, Secretary, and Treasurer, it was discovered this year that eleven people were still on the Secretary's roll, that had been delinquent for their dues for from one to three years. These names have been removed and it is now felt that the Secretary's records are correct.

At the time of the last annual report, there were 54 members delinquent for dues. Ten of these members paid and were reinstated while the rest (44) were dropped from our rolls.

It is with much regret that the list of 1931 delinquent members is announced. There is a total of 137 members delinquent for 1931 dues. These are distributed as follows: Sustaining Members, 8; Active Members, 21; Associate Members, 108.

Jesse M. Shaver, *Secretary.*

*Revised to the end of December, 1931.

†Two of the Life Members are also Honorary Members.

KEY TO GROUP PHOTOGRAPH. 1. Lynds Jones. 2. Jesse M. Shaver. 3. T. C. Stephens. 4. Mrs. W. H. Edwards. 5. Mrs. A. F. Satterthwait. 6. Mrs. Lynds Jones. 7. A. W. Meyer. 8. Mrs. W. S. Randall. 9. H. C. Bryant. 10. Josselyn Van Tyne. 11. Mrs. H. J. Taylor. 12. S. Charles Kendeigh. 13. W. F. Kubichek. 14. Fannye Cook. 15. Frank Carroll. 16. C. B. Claycomb. 17. Charles V. Robinette. 18. T. Gilbert Pearson. 19. Mrs. C. B. Claycomb. 20. Glenn W. Bell. 21. Paul A. Stewart. 22. Albert Ganier. 23. E. L. Moseley. 24. Paul R. Elliott. 25. Lony Strabala. 26. Kenneth Edwards. 27. J. Paul Visscher. 28. W. H. Over. 29. O. P. Allert. 30. W. D. Johnson. 31. Chas. J. Spiker. 32. Duncan McIntosh. 33. F. A. Harris. 34. Richard H. Wade. 35. Ethel B. Finster. 36. Mrs. O. P. Allert. Photographs of this group, 8x10 inches, may be secured at $1 each from John N. Tennisson, 1525 Eighth Street, New Orleans, La.

REPORT OF THE TREASURER FOR 1931

From December 19, 1930 to December 21, 1931

Receipts for 1931

December 19, 1930, Balance on hand as per last report		$ 675.15
The following was collected from members and subscribers:		
6 Associate Members for 1930	$ 9.00	
3 Active Members for 1930	7.50	
388 Associate Members for 1931	582.00	
197 Active Members for 1931	492.50	
55 Sustaining Members for 1931	275.00	
93 Associate Members for 1932	139.50	
44 Active Members for 1932	110.00	
14 Sustaining Members for 1932	70.00	
5 Associate Members for 1933	7.50	
1 Active Member for 1933	2.50	
From membership dues		1,695.50
99 Subscribers for 1931	148.50	
35 Subscribers for 1932	52.50	
1 Active Subscriber for 1931	2.50	
13 Foreign Subscribers	24.06	
5 Fractional Subscriptions	5.79	
From subscriptions		233.35
Received for back numbers sold	23.00	
Received various contributions	7.10	
Received from Mrs. H. J. Taylor	50.00	
Received Trust refund	1.00	
Received membership list sold	1.00	
Miscellaneous receipts		82.10
Total receipts		$2,686.10

DISBURSEMENTS FOR 1931

(Condensed Form)

Printing four issues of the BULLETIN	$1,366.50	
Other expenses in Editor's office	135.85	
Halftones, engravings, cuts, etc	143.49	
Publication costs		$1,645.84
Expense in Secretary's office	249.64	
Expense in Treasurer's office	41.73	
Dr. Stephens for excess remittance	10.00	
Five fractional subscription refunds	5.75	
Arizona University check returned	1.50	
Exchange on foreign checks	.63	
Running expenses		309.25
Total disbursements		$1,955.09
December 21, 1931, Balance on hand		731.01
Total		$2,686.10

(A complete itemized list of expenses is attached)

ENDOWMENT FUND

December 19, 1930, Balance on hand in Endowment Fund (See last annual report)	$888.35
Received interest on Endowment Fund at 4% (Savings department of City State Bank, Ogden, Iowa)	35.88
December 21, 1931, Balance on hand in Endowment Fund	$924.23

Respectfully submitted,

(Signed) W. M. ROSENE, *Treasurer.*

Register of the Attendance at the New Orleans Meeting

From Alabama: Thomas S. van Aller, Mobile: Kenneth Edwards, Mrs. W. H. Edwards, and Duncan McIntosh, Fairhope: P. H. Lodier, Newbie; H. E. Wheeler, Birmingham. From California: Mrs. H. J. Taylor, Berkeley. From District of Columbia: H. C. Bryant, Washington. From Florida: Grace E. Baker, Tallahassee; Mr. and Mrs .C. C. Goff, Leesburg; T. R. Robinson, Terraleia; C. H. Willoughby, Gainsville. From Georgia: Glenn W. Bell, Mount Berry; Mrs. E. F. B. Cobb, Atlanta; Mr. and Mrs. Marvin C. Quillian, Macon. From Illinois: Victor E. Shelford, Urbana. From Indiana: W. S. Blatchley, Indianapolis; M. S. Markle, Richmond. From Iowa: Mr. and Mrs. O. P. Allert, McGregor; F. A. Harris and Chas. J. Spiker, New Hampton; Mr. and Mrs. W. F. Kubichek, and Mr. and Mrs. A. W. Meyer, Cedar Rapids; T. C. Stephens, Sioux City. From New Orleans: Stanley C. Arthur, Mrs. E. A. Bechtel, Frank M. Carroll, Miner B. Conger, James W. Edwards, A. W. Harrison, E. S. Hopkins, Harnett T. Kane, William Letter, Buford M. Meyers, Jr., Richard H. Wade. From Louisiana outside of New Orleans: H. J. Chatterton, Mr. and Mrs. G. B. Claycomb, Lafayette; Mildred Dunn, K. S. Foote, J. R. Fowler, Baton Rouge; and W. D. Johnson, and Grace Sharp, Shreveport. From Massachusetts: Mabel E. Bowman, Cohasset. From Michigan: Josselyn Van Tyne, Ann Arbor. From Mississippi: Fannye A. Cook, Crystal Springs; P. E. Collom, McComb; Mr. and Mrs. John M. Frazier, Hattiesburg. From Missouri: Louise Becker, and Helen Dykeman, St. Louis; Mr. and Mrs. A. F. Satterthwait, Webster Groves. From New York: Mrs. Charles Noel Edge, Peter Edge, and T. Gilbert Pearson, New York City. From Nebraska: Robert H. Wolcott, Lincoln. From North Carolina: Ethel B. Finster, Ashville: A. Shaftesbury, Greensboro; Mr. and Mrs. J. M. Vallentine, Chapel Hill. From Ohio: Mary C. Crone, S. Charles Kendeigh, J. Paul Visscher, Cleveland; Lawrence E. Hicks, and Robert H. McCormick, Columbus; Dr. and Mrs. Lynds Jones, Oberlin; C. Mae McAdow, Peebles; E. L. Moseley, Bowling Green; William A. Rice, Delaware; Paul A. Stewart, and Lony B. Strabala, Leetonia; Allan H. Watkins, Chardon. From Oklahoma: Mrs. W. S. Randall, Oklahoma City; J. L. Selb, Tahlequah. From South Dakota: W. H. Over, Vermillion. From Tennessee: Paul R. Elliott, Richard City; A. F. Ganier, and Jesse M. Shaver, Nashville. From Texas: Don O. Baird, Huntsville; Homer R. Bolen, and Otto Mackensen, Austin; J. J. Carroll, Houston; R. T. Hartley, Beaumont. From Wisconsin: L. J. Cole, and R. J. Barlen, Madison.

Summary of Attendance

Alabama, 6; California, 1; District of Columbia, 1; Florida, 5; Georgia, 4; Illinois, 1; Indiana, 2; Iowa, 9; Louisiana (outside of New Orleans), 8; New Orleans, 11; Massachusetts, 1; Michigan, 1; Mississippi, 4; Missouri, 4; Nebraska, 1; New York, 3; North Carolina, 4; Ohio, 13; Oklahoma, 2; South Dakota, 1; Tennessee, 3; Texas, 5; Wisconsin, 2. Total attendance, 92. Total outside of New Orleans, 81. Number at dinner, 35.

TO OUR CONTRIBUTORS

Our members are urged to submit articles for publication in the BULLETIN. Short items are desired for the department of General Notes, as well as longer contributions, especially pertaining to life-history, migration, ecology, behavior, song, economic ornithology, field equipment and methods, etc. Local faunal lists are also desired, but they should be annotated, at least briefly, and should be based upon sufficient study to be reasonably complete. Authors are asked to include the common name, the scientific name (from the A. O. U. check-list), and annotations, and they should be arranged in this order. The annotations should include explicit data concerning unusual species. Omit serial numbering.

THE MANUSCRIPT. The manuscript, or copy, should be prepared with due regard for literary style, correct spelling and punctuation. Use sheets of paper of good quality and of letter size (8½ x 11 inches); write on one side only, and leave wide margins, using double spacing and a reasonably fresh, black ribbon.

The title should be carefully constructed so as to indicate most clearly the nature of the subject matter of the contribution. Where the paper deals with a single species it is desirable to include in the title both the common and the scientific names, or, to include the scientific name in the introductory paragraph. Contributors are requested to mark at the top of the first page of the manuscript the number of words contained. This will save the editor's time and will be appreciated.

Manuscripts intended for publication in any particular issue should be in the hands of the editor sixty to ninety days prior to the date of publication.

ILLUSTRATIONS. To reproduce well prints should have good contrast with detail. In sending prints the author should attach to each one an adequate description or legend.

BIBLIOGRAPHY. The scientific value of some contributions is enhanced by an accompanying list of works cited. Such citations should be complete, giving author's name, full title of the paper, both the year and volume of the periodical, and pages, first and last.

PROOF. Galley proof will be regularly submitted to authors. Page proofs will be submitted only on request. Proof of notes and short articles will not be submitted unless requested. All proofs must be returned within four days. Expensive changes in copy after the type has been set must be charged to the author.

SEPARATES. The Club is unable, under present financial conditions, to furnish reprints to authors gratis. Arrangements will be made, however, for such reprints to be obtained at practically cost. The cost will vary somewhat with the nature of the composition, but will depend mainly upon the number of pages. A scale of rates is appended which will serve as a guide to the approximate printer's costs.

If a blank page is left in the folding this may be used for a title page, which will be set and printed at the rate indicated. If a complete cover with printed title page is desired it may be obtained at the rate shown in the last column. All orders for separates must accompany the returned galley proof upon blanks provided. Orders cannot be taken after the forms have been taken down.

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100	1.50	2.25	3.75	5.00	6.25	7.50	8.75	10.00	11.25	12.50	13.75	2.75
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Annual Meetings of the Wilson Ornithological Club

	Retiring President
1914—Chicago. February 5. Chicago Academy of Sciences.	
1914—Chicago. December 29-30. New Morrison Hotel	T. C. Stephens
1915—Columbus. December 28-29. With the A. A. A. S.	T. C. Stephens
1916—Chicago. December 27-28. New Morrison Hotel	T. C. Stephens
1917—Pittsburgh. January 1-2, 1918. With the A. A. A. S.	W. F. Henninger
1918—No meeting on account of the exigencies of war	M. H. Swenk
1919—St. Louis. December 29-30. With the A. A. A. S.	M. H. Swenk
1920—Chicago. December 27-28. With the A. A. A. S.	R. M. Strong
1921—Chicago. December 26-27. The Field Museum	R. M. Strong
1922—Chicago. October 26	T. L. Hankinson
1923—Cincinnati. Dec. 31, 1923-Jan. 1, 1924. With the A. A. A. S.	T. L. Hankinson
1924—Nashville. November 28-29-30. Peabody College	A. F. Ganier
1925—Kansas City. December 28-29. With the A. A. A. S.	A. F. Ganier
1926—Chicago. November 26-27. Chicago Academy of Sciences	A. F. Ganier
1927—Nashville. Dec. 30, 1927-Jan. 1, 1928. With the A. A. A. S.	Lynds Jones
1928—Ann Arbor. Nov. 31-Dec. 1, 1928. Museum of Zoology	Lynds Jones
1929—Des Moines. December 27-28. With the A. A. A. S.	Lynds Jones
1930—Cleveland. December 29-30. With the A. A. A. S.	J. W. Stack
1931—New Orleans. December 28-29. With the A. A. A. S.	J. W. Stack

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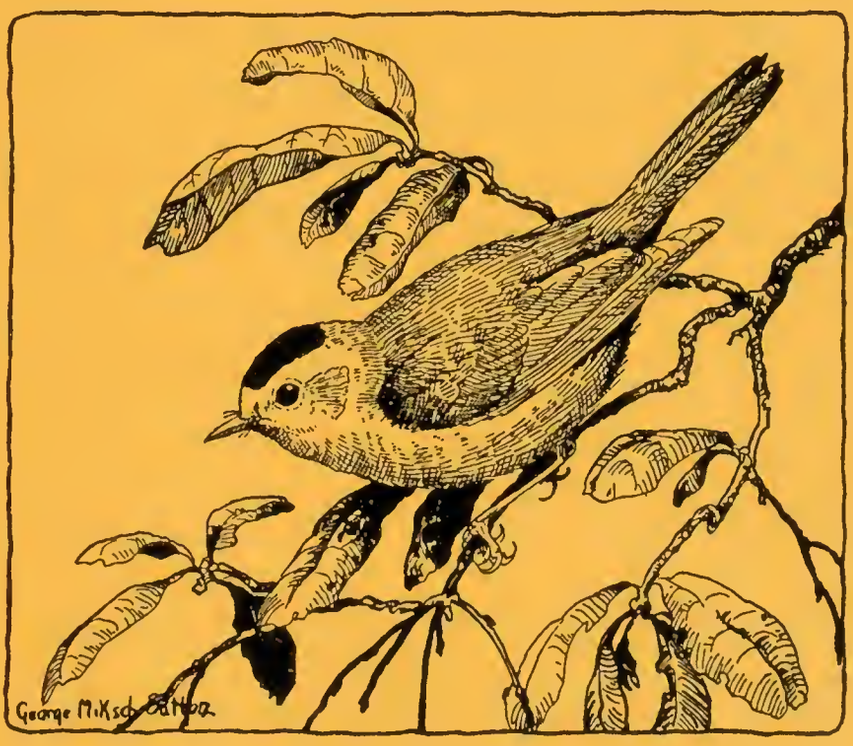
Vol. XLIV JUNE, 1932 No. 2

THE WILSON BULLETIN



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All articles and communications for publication, books and publications for notice, and exchanges, should be addressed to the Editor.

Claims for lost and undelivered copies of the magazine may be addressed to the Editor.

THE WILSON ORNITHOLOGICAL CLUB

Founded December 3, 1888. Named after Alexander Wilson, the first American ornithologist, and called the "Father of American Ornithology."

The officers for the current year are:

President—Prof. J. M. Shaver, George Peabody College for Teachers, Nashville, Tenn.
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The membership dues are—Sustaining membership, $5.00; active membership, $2.50; associate membership, $1.50 per year.

The following societies are affiliated organizations:

The Nebraska Ornithologists' Union.
The Iowa Ornithologists' Union.
The Kentucky Ornithological Society.
The Tennessee Ornithological Society.

THE WILSON BULLETIN

A QUARTERLY MAGAZINE OF ORNITHOLOGY

Published by the Wilson Ornithological Club

Vol. XLIV JUNE, 1932 No. 2

Vol. XXXIX (New Series) Whole Number 159

WINTER STARLING ROOSTS OF WASHINGTON

BY E. R. KALMBACH

The winter Starlings of Washington are in no wise different from other Starlings. They are as typically Starlings as the cosmopolitan citizenry of the National Capital is American. They have all the individual vices, much of the proletarian spirit and doubtless also some of the less frequently mentioned virtues of Starlings living elsewhere. Yet, withal, they have distinction. The mere choice of the National Capital as their winter domicile assures them that.

Here their nocturnal squeals and chatterings reach the ears of the mighty and here also at times the voices of the mighty rise in protest. Here the shopper and the shop owner; the pedestrian and autoist; the bird hater and even bird lover periodically join the chorus of damnation. Even the staid ranks of profound ornithologists have echoed the song of lament.

It is in such an unsympathetic setting that the appended notes on Starling behavior have their origin. They are devoted in general to the subject of roosting activities and in origin are more or less of a by-product of a few experiments in control. In point of time they deal largely with the happenings of the past five years.

Winter Starlings made their first appearance in Washington in the fall of 1914, when a few score used trees near the Bureau of Fisheries as a rendezvous. At that time they were objects merely of ornithological interest and made no impression on the lay mind except as attention was called to their presence. On the advent of colder weather these birds either left the city for points south or passed the nights in more protected and less conspicuous places, as the interiors of church towers or building ventilators. It was not until about 1922 or 1923 that noticeable numbers began to frequent the eaves and window ledges of buildings on down-town streets and formed a nucleus of what in following years developed into a roost of many thousands.

By January, 1926, the gathering had reached such proportions that local merchants complained of its presence, and, in a limited way,

experiments were started to alleviate the condition. These early experiments, involving frightening measures, were followed by attempts to trap the birds, then to poison, and finally experimental work was done with toxic gas on small mixed roosts of Starlings and English Sparrows. The rather high degree of failure, tempered with indifferent success in a few of the experiments, carried with it the conviction that there still was much to learn of Starling behavior that might have a bearing on the general problem of Starling eontrol where needed. Of primary importanee was the need of a better understanding of Starling migration or seasonal drift in order that the effect of a winter reduction of numbers at any one point might better be appraised. This led to banding operations.

The first of these attempts to band winter Starlings in Washington was directed at a group roosting in two ventilators on top of the Post Office Department Building on Pennsylvania Avenue. There were four of these ventilators, essentially the same in construction. Starlings, however, occupied only two, these being the ones from which a steady flow of warm air emerged throughout the night, and where the birds, proteeted from rain and snow by the broad, overlapping shutters, enjoyed the advantages of almost human comforts. Fully a thousand birds resorted to each of these ventilators during the height of their occupancy in the winter of 1927-28. On December 21, 1927, a party of four, consisting of C. C. Sperry, F. M. Uhler, F. C. Lincoln, and the writer visited these ventilators and succeeded in capturing a single Starling. There was no method of reaching the birds from the inside and the diffused light of the city made our approach from without so evident that most of the flock took wing at the start of operations. This single experience was suffieient and the seene of operations was promptly changed to the tower of the First Presbyterian Church on John Marshall Place where, during this same winter, as many as 2600 Starlings repaired nightly. This tower had been used by Starlings for several years and by pigeons for many more. The former were eontributing rapidly to the supply of guano which on some landings was eight to ten inches deep. About a quart of this material yielded the remains of no less than 105 specifieally different food items of the Starlings. More than half of these were animal in origin and the varied assortment gave indieation of the wide daily rangings of this flock up and down the Potomac and throughout neighboring Maryland and Virginia.

Banding was begun at this loeation on the night of January 4, 1928, when 317 were banded. An even thousand were tagged on Janu-

ary 14 and another thousand on February 21. The peak of operations was reached on the night of March 2 with the banding of 1,241, and the season closed on March 23 with 559, making a total of 4,118 for the winter. In the following winter (1928-29) 398 additional Starlings were caught and banded in the tower of the Metropolitan Me-

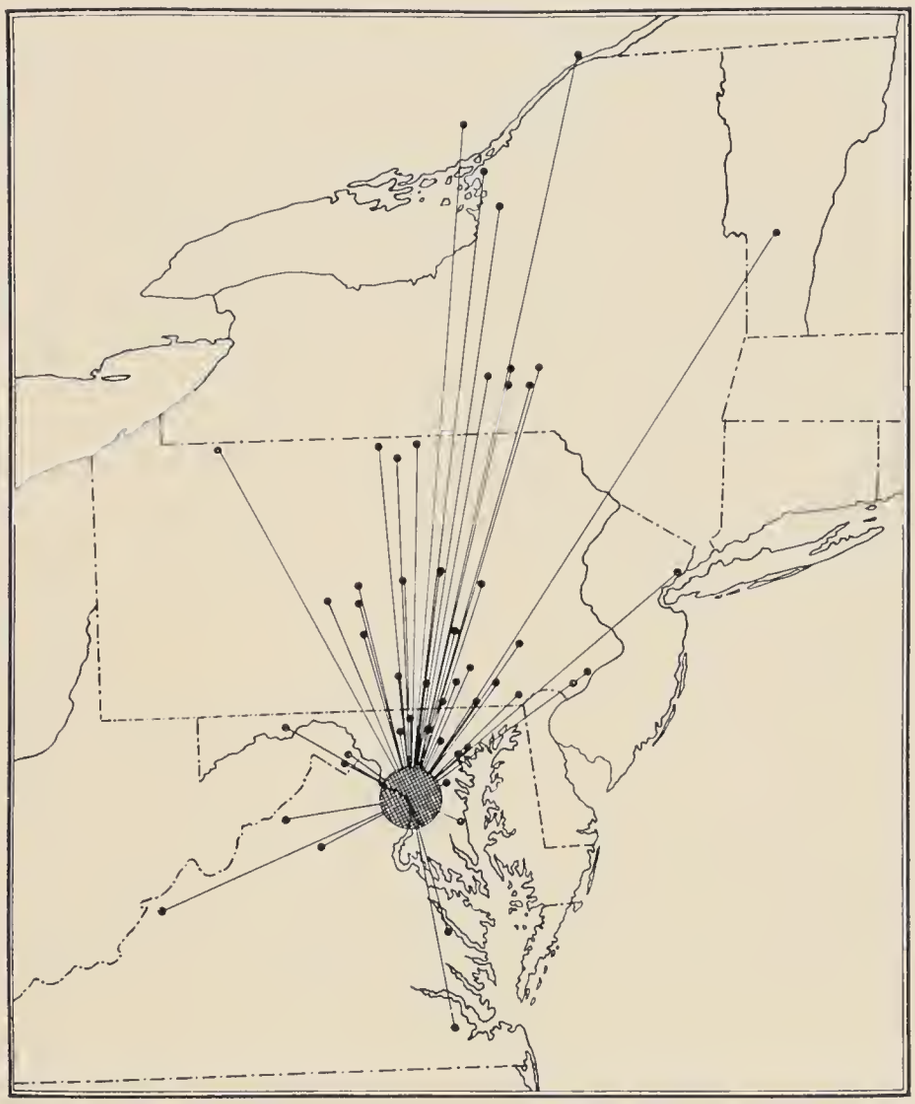

Fig. 14. Map showing the 120 returns from 4,516 Starlings banded in Washington in the winters of 1927-28 and 1928-29. Seventy birds were recovered at points within the shaded circle, having a radius of twenty miles from the point of banding. The most distant return (Cornwall, Ontario) is about 480 miles distant from Washington.

morial M. E. Church, situated only a half block from the scene of the earlier banding. In the course of this work a number of Washington ornithologists other than those mentioned, coöperated.

At the time of this writing (March, 1931) 120, or about 2.6 per cent of the total number of Starlings banded in these two winters

(4516) have been recorded as returns. (See Fig. 14). Seventy of these returns have been recorded from points less than twenty miles distant from the point of banding. Of these seventy essentially local returns, twenty-eight were recorded during subsequent breeding seasons and for that reason may be looked upon as resident birds. A portion also of the other forty-two local returns, birds captured or killed during winter months, probably were local breeders. Arguing from these admittedly meager data, it may be contended that something more than 23 per cent of the wintering Starlings of Washington were essentially resident birds. For that reason a reduction in the number of winter Starlings at Washington may be expected to exert a certain influence on the local breeding population but, of the birds eliminated, probably more than half would be northern breeders. Wallingford, Vt., Cape Vincent, N. Y., and Cornwall and Elgin, Ontario, are the most northerly points of return among the birds banded. The few records of return noted in Fig. 14 at points to the south of Washington are of birds captured during subsequent winters and indicate possibly that those individuals had merely gone on past Washington in their southern drift toward warmer climes.

The Starlings in the first of the towers visited, which is an old one, occupied various ledges and nooks in the walls as well as the cross braces. At a certain level there was a series of box-like cavities in the wall construction, each about two feet wide, three feet deep, and six inches high. These were filled with Starlings for their entire depth with scarcely room for another, and, despite an outdoor temperature of well below freezing, I am confident a thermometer placed among these birds would have registered a temperature close to that of their own bodies. We ourselves were able to keep perfectly comfortable, even though working bare-handed on cold nights, by frequently delving arms' length into one of these cavities to drag forth a double handful of Starlings. This habit of dense crowding is quite different from that displayed by Starlings when roosting in trees or on the exterior of some buildings where there is ample room. In such locations the birds appear to resent close association and aim to keep between each other a space equal to at least the width of a bird. (Fig. 15). The intrusion of another individual into a line at such a gathering is resisted, but if the newcomer is successful in establishing itself there follows a slight shifting of birds on each side in an attempt to equalize and keep at a maximum the interval between each.

Each successive night of banding at the church tower disclosed a certain number of "repeats" from our earlier bandings. It was also

FIG. 15. A count made from the negative of this picture reveals about 1,000 Starlings in the top of this sycamore tree on Pennsylvania Avenue, Washington. The photograph was taken before sunrise.

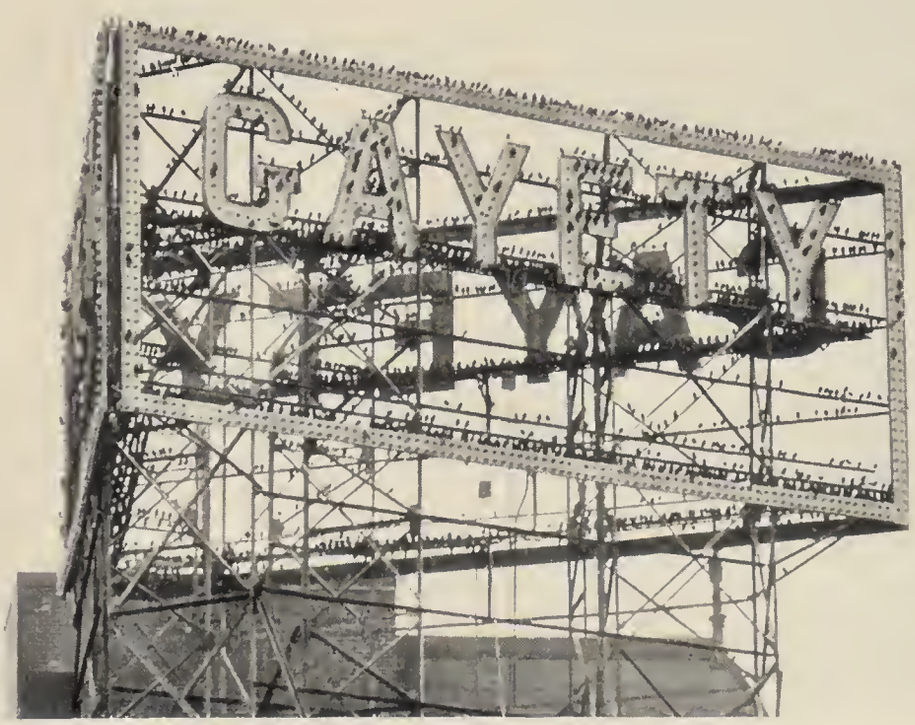

FIG. 16. "Gayety" is the keynote of this assemblage of approximately 3,000 Starlings on the top of a burlesque theatre in Washington.

Photographs by E. R. Kalmbach.

apparent that these operations were causing a decrease in the total population of the tower as we had to go to higher and higher levels to obtain the birds. It was not until the last banding of the first year (March 23, 1928) that we were able to capture practically every bird in the tower. On that evening it was necessary to climb to the very top of the cupola to obtain the last two hundred birds. Among these last birds *there was not a single "repeat"* although for that entire evening "repeats" averaged close to a fifth of the birds handled. Even previous to this night it had been noted that there was a tendency for the numbers on the "repeats" to be bunched in a fairly close sequence, much in the order in which they were originally banded. A group of fifty birds removed from one cavity might have six or eight "repeats" and the numbers of these repeats often were in close proximity in the numerical series, indicating, it was thought at that time, that each individual bird had returned to the same spot in the tower that it had occupied at the time it was banded. The absence of "repeats" among the last two hundred birds obtained from the peak of the cupola, which had not been visited before, strengthened this belief.

With the decrease in the number of birds in this tower, came an approximately corresponding increase in the number of Starlings using the ledges beneath the eaves and porticos of the former Land Office and the Patent Office buildings about one-fourth mile to the northwest. A few hundred also repaired to the tall spire of the Metropolitan M. E. Church just a half block to the south. This latter tower was the scene of the banding operations during the following winter (1928-29) when, after two "expeditions" on which 398 were banded, it also became unattractive to the birds. Today, three or four years after these operations, the two towers mentioned remain nearly free of Starlings, despite the fact that they are just as accessible as they ever were and that the local Starling population of Washington still is great.

Although the treatment given the birds when being banded was a bit rough at times, it was not more than the rugged Starling could ordinarily withstand. They were gathered in gunny sacks in lots of forty or fifty, brought down to a lower level, inspected for bands previously placed, banded and then released by tossing them out of a window. This compelled the birds to seek other more peaceful spots of repose for the rest of the night. Inspection of the premises by day on several occasions revealed only one dead Starling that had been handled on the previous night. There certainly was no great mortality. The summary ejection of the birds from the tower with the resultant

necessity on their part of finding new nightly abodes appeared to be the impelling factor that caused the desertion of these roosts. In one of the two towers a carillon of bells, on the framework of which many of the birds roosted, was in no sense a disturbing factor as not a bird was seen to leave the tower while Christmas carols and glad tidings of the new year were being tolled.

After the center of Washington's Starling population had moved to the old Land Office Building late in the winter of 1927-28, observations and certain control experimental work shifted to that scene. Here the birds occupied protected ledges beneath the eaves and on the frames of the upper story windows. The capital of every Corinthian column also had its quota and the regular dispersal of the birds in measured spaces permitted easy estimation of numbers. During the peak of occupancy in the winter of 1929-30, this building harbored nightly about 4,200 Starlings. Here further and more definite evidence of the attachment shown by individual Starlings for the same roosting spot was revealed. It came to light in connection with an experimental demonstration of a scheme to reduce the nuisance of roosting Starlings by eliminating the roosting ledges. The tops of the upper story windows across the entire south side of the old Land Office Building were occupied, each with its ten to fifteen birds. One of these roosting sites was eliminated by placing on the ledge a strip of wood having an end cross section of a right triangle and a length equal to the width of the window. In this manner an inclined surface sloping outward and downward at an angle of 45° from the horizontal displaced the flat ledge about three inches wide. On this incline the birds could not, or at least did not roost. This strip was placed in position on March 14, 1928, where it remained until the night of the 16th, when it was dislodged by the wind. On the night of the 17th every window of the upper story had its regular quota of birds in orderly array except the one on which the strip had formerly rested. This ledge remained absolutely free of Starlings notwithstanding the fact that now it was just as suitable as any other ledge and that there were mad scrambles for lodging space on neighboring windows scarcely eight feet away. On the night of the 18th one bird timidly occupied the extreme end of the vacated ledge and on following nights it was gradually repopulated.

At about the same time a somewhat similar experience was had with Starlings occupying a portico at the opposite end of this building. An automatic acetylene flash gun was fired in this portico for several consecutive nights causing a portion of the birds to seek quieter lodgings. The results were not as successful as hoped for and the

firing was stopped. The birds, however, did not return to the vacated ledges immediately and it was only after a period of several days that the area was slowly reoccupied.

A more recent happening emphasizes further the fact that once a Starling has been driven from a roosting spot and *has located itself at some other point* there is no urge to return to its earlier roost unless driven from its new abode. It occurred at the scene of this same center of Starling population, which had grown to considerable proportions and occupied not only all four sides of the old Land Office Building but also parts of the Patent Office to the north. On the 9th of February, 1931, a crew of eight men, four to each building, started a crusade against the roosting birds. Cat-o-nine tail whips of short poles with several strands of flexible wire attached were used to lash the ledges beneath the eaves. The men operated from the roof of the building. This was repeated on a second night and the work was supplemented by some of the men using "bean shooters", with small stones as projectiles, to dislodge birds that could not be reached with the whips. By the third night the roost was much reduced in size and the whips were abandoned entirely for the sling shots. The crew also was reduced to two men for each building. By the fourth night practically all the birds had left and two men leisurely patrolling from the sidewalk kept the few more persistent birds on the move.

Since then, these two buildings, which together harbored probably in excess of 6,000 birds, have been free of Starlings. It is true a single man goes through the perfunctory procedure of patrol but it is not needed. There is a complete avoidance of the building on the part of the birds. Now and then a small group will fly toward it as if to alight on one of the ledges; they may even perch for a moment or two but it is not for long. As far as these two buildings are concerned the relief from the Starlings has been complete. Yet immediately across the street an electric sign, gaily occupied by the birds, afforded lodging for about 3,000 (Fig. 16), a few of which showed any interest in or inclination to return to their old ledges scarcely 100 feet away. The rest of the evicted tenants found other spots in down-town Washington with a noticeable drift westward along F and G Streets. Even the District Building about a half mile away, from which the Starlings departed about a year previous in response to frightening measures, again had a substantial delegation. Each individual Starling could be expected to return to its own newly found nook or cranny and the old stands at the Patent Office, the old Land Office Building, as well as at the church towers previously mentioned will likely remain

unoccupied as long as the birds are *not further disturbed* at their new locations.

The affinity of Starlings for individual roosting spots seems to account for the sequence of events occurring at roosts in the course of a single winter, or even a series of winters, if we assume there to be a certain homing instinct lasting from one season to another. A group of adult birds, returning to old haunts, might well be expected to decoy the young of the previous breeding season and in that manner a winter roost might be maintained at the same location for a series of years.

The idea of a particular roosting spot for each individual bird is, I find, at variance with the popular conception of large Starling roosts. To the casual observer these congregations convey the impression of a mad scramble to find roosting spots. There is, in fact, a scramble but behind it all there exists, I believe, the impelling desire of each bird to find its own particular location. Admittedly there is confusion, especially when there are new arrivals at the roost or when the roosting birds have been disturbed by man or other causes. But, all in all, these nightly gatherings may be little more of a riot than what one sees at any football game when each of 50,000 or more spectators is attempting to plant himself in his own reserved seat before the start of the game.

There is need for more direct and positive evidence of the trait these observations have indicated largely in a circumstantial way. This could be obtained by observing, night after night, conspicuously marked birds. Just how one would succeed in capturing and marking Starlings at one of the open roosts where they could be watched from day to day, without unduly disturbing the group I cannot say. Starlings are remarkably uniform in appearance but I hope sometime to have the good fortune to locate one or more individuals that are distinguishable so that their movements may be readily detected.

Despite the constancy with which Starlings return night after night to an established abode, motives bordering either on fickleness or an astute sense of danger at times seem to govern their movements when they decide to vacate. The occupancy of a new roost then may take on the aspect of a deliberate and willful avoidance of their former rendezvous. An incident that well illustrates such a case occurred within recent years in a nearby community in Virginia. A mixed flock of English Sparrows and Starlings roosted, to the great distress of the owner of the property, in the ivy covering the brick walls of a large and stately dwelling. A plea for some relief led to an experiment in the use of calcium cyanide dust as a fumigant. This was

fairly successful and the roost was materially reduced in size but not eliminated. Several dozen birds still remained but, during the days following, these also gradually vacated the premises and sought other roosting places. For the remainder of that season and in subsequent years these ivy covered walls harbored neither English Sparrows nor Starlings, though all essential features that originally attracted the birds still remained.

Compared with the drastic action taken without success against some bird roosts, our activities against the Starlings roosting in the tower of the First Presbyterian Church in Washington were mild and inoffensive. Yet five nights of banding at widely scattered dates so offended Starling sensibilities that they all left and few ever returned. Even more decisive was the manner which the Starlings vacated the ventilators on the Post Office Building. One night's visit of a banding party seemed sufficient to cause a rapid decrease in numbers on following nights until the roost was utterly forsaken.

A similar reaction has been noted with other species. I have known Crows to vacate enormous roosts apparently through the loss of a comparatively few birds through poisoning. Red-winged Blackbirds and Boat-tailed Grackles react similarly in their feeding areas. Stoddard and Handley seldom found individual Chimney Swifts returning to the chimney in which they had been collected, and Dr. A. K. Fisher relates that some years ago a little persecution of English Sparrows at Governor Pinchot's home in Milford, Pa., resulted in the birds abandoning the ivy covered walls throughout ensuing years although the barns a few hundred yards distant still harbored them.

The only thoughts I have to offer on such experiences are the following: There seems to be no dearth of roosting facilities that are acceptable to the birds. Neither are there any inseparable ties or affinities to draw birds back to a roost once it has been definitely vacated and the birds established elsewhere. As I look back, however, over many varied experiences with bird roosts I am unable to explain why, on some occasions the most energetic and persistent efforts at roost eradication fail miserably and on others, little more than a suggestion to move meets with a favorable response. The uncanny ability to detect conditions that spell real danger, especially on the part of Starlings, blackbirds, and Crows, is to me another unexplained trait that often comes to light in problems of economic ornithology. However often it occurs and to whatever extent it may frustrate or alter well laid plans for control, I never fail to marvel at it. After

all it is such non-predictable reactions as these that add so much to the interest of economic ornithology and convince us that however exact our scientific findings may be we can not expect the actions of living birds to conform to formulae.

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CURVATURE OF WING AND FLAPPING FLIGHT

BY WILLIAM BREWSTER TABER, JR.

In the last issue of the Wilson Bulletin (XLIV, 1932, pp. 19-22) my paper on "Curvature of Wing and Soaring Flight" gives in detail the explanation of the effect of the curvature of the wing and how the air currents striking the under wing surface are deflected, thus causing an upward lift and a thrust forward, in this way supplying the necessary power for soaring flight. In making this explanation clear it was necessary to resort to a velocity diagram involving technical terms. So as to avoid repetition here I will ask the interested reader to acquaint himself with the technical terms and their meanings as given in this previous paper.

In figure 17, upper diagram, I have represented by the heavy curved line *CD* the cross section of a wing of a bird flying to the left in a horizontal direction as indicated by the arrow above the diagram. We will consider in this case that the bird is flying in motionless air and that the wing is flapping straight downward. By bringing the wing straight downward the same effect is produced upon the wing as if the wing were held motionless and an air current were blowing straight upward against it. (Here let me say that to understand this problem it is essential to keep constantly in mind that the velocity lines represent the directions and velocities of air currents *in relation to the wing*, and not to the body or any other part of the bird or to an observer standing on the ground). The line *BC* represents this upward air current, the arrow on the line showing the direction, and the length of the line representing the velocity of this air current. Since the bird is flying horizontally to the left, the line *AB* has been drawn representing the current of air passing by the wing to the right. The resultant of the two components *AB* and *BC* is *AC*. In other words, the combined effects upon the wing of the two air currents, *AB* due to the motion of the bird to the left, and *BC* due to the motion of the wing downward, is equivalent to a single current blowing upon the wing in the direction *AC* and of a velocity proportional to the

length of *AC*. In an ideal case this air current will just slide in under the front edge, swing around along the under surface of the wing and come off at the back edge in a direction tangential to the wing at *D* as shown by the line *DF*. As this is an ideal case loss of energy due to friction or eddying need not be considered, hence I have drawn *DF* exactly the same length as *AC*. The vertical component of *DF* is *DE*. Hence the total lifting effect upon the bird wing is proportional to the length of *BC* plus *DE*. Now it can readily be seen that *EF* is longer than *AB*. Since *EF* is longer than *AB*, or in other words since the horizontal velocity of the air current coming off the back edge of the wing is greater than the horizontal velocity of the air current coming in under the front edge of the wing there is a thrust forward, and the thrust forward is proportional to the difference in length of *EF* and *AB*. Consequently by bringing the wing sharply downward the bird produces a combination of air currents which, since they are deflected by the curved under surface of the wing, produce an upward lift which is opposed to the force of gravity, and a forward thrust which tends to move the bird forward. Whether or not successful flight is accomplished depends upon a number of other conditions such as the position of wing in relation to the various actual air currents, area of wing surface, weight, and other numerous factors.

No doubt by this time the reader has noticed that I have used a similar diagram and given a similar explanation in this paper on flapping flight to that which I did on soaring flight. It can readily be seen that this is perfectly justifiable, for in soaring flight when the wings are held motionless the bird is dependent upon upward moving air currents, while in flapping flight the bird obtains the same effect by bringing its wings sharply downward.

The Advantage of the Forward Downward Wing Stroke. It is common knowledge that birds in ordinary flapping flight not only bring their wings downward, but at the same time swing them forward. This may be easily observed by watching the slow flapping flight of any birds as large as, or larger than, the Crow. The rapidity of wing beat of smaller birds makes this observation upon them very difficult, or impossible, to the unaided eye. It is a fact that the effectiveness of the wing beat is greatly increased by this forward downward motion. I will, therefore, devote the remainder of this paper to explaining how this is.

We will now consider that the bird is flying under the same conditions as were given in the first part of this article, that is, to the left and in a horizontal direction and in still air, but with a forward down-

ward wing stroke rather than with a straight downward wing stroke. In figure 17, lower diagram, *ACB* has been drawn exactly the same as in the upper diagram. The line *BC* represents the velocity of the air current acting on the wing caused by a straight downward wing beat. Line *AB* represents the velocity of the air current acting on the wing caused by the horizontal motion of the bird to the left. While *AC* is the resultant of these two. Now, in the upper diagram, anything that increases the resultant *AC* will also increase *DF* and hence will increase the vertical component *DE* and the horizontal component *EF*. If this increase is accomplished, since *DE* represents the vertical velocity of the air current coming off the back edge of the wing, the

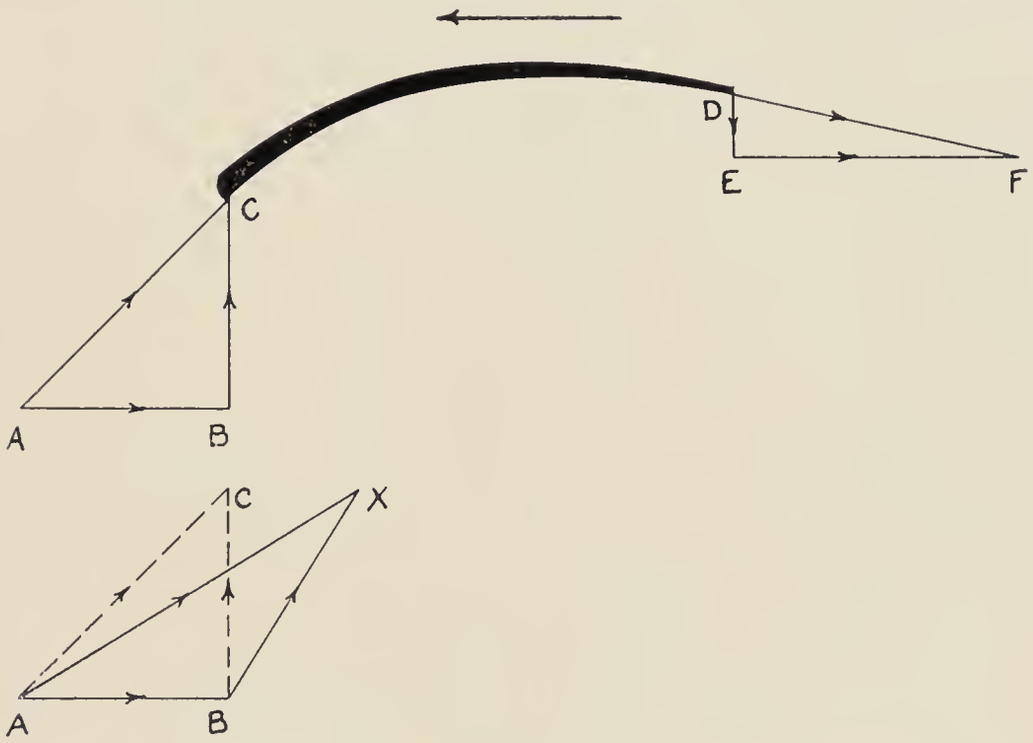

Fig. 17.

upward lift caused by the wing beat will be increased. Likewise since *EF* represents the horizontal velocity of the current of air coming off the back edge of the wing, the forward thrust will be increased.

Now the question is, will the forward downward wing beat increase the resultant *AC* and thus bring about all the attendant effects outlined above. In the lower diagram if, instead of drawing the component *BC* straight up as it would have to be in the case of a straight downward wing beat, we draw the corresponding component *BX* in the direction as shown, as it would have to be if the wing beat were forward and downward in the direction from *X* to *B*, then the resultant would be *AX*. It can be seen at a glance that *AX* is much longer than

AC, and therefore the resultant air current velocity would be much greater than in the case of the straight downward wing beat. Since with the forward downward wing beat the air would slip under the front edge of the wing with greater velocity it would also come off the back edge with greater velocity. So the downward horizontal and velocity components would be proportionately increased, and hence the lift upward and thrust forward would be increased.

This explains why the forward downward wing stroke is so much more effective than the straight downward wing stroke, and hence is the wing motion usually employed in flapping flight.

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HARLAN'S HAWK*

BY NORMAN A. WOOD

Harlan's Hawk (*Buteo borealis harlani* (Audubon)) has interested me for many years past, but more so since I received my first specimen, taken May 1, 1916, in northeastern North Dakota by H. V. Williams, who has since that time sent me fifty more from the Red River Valley. From a small area in northwestern Arkansas I have added eighty more, and seven others from different states, or 137 in all. The last mentioned eighty-seven of these birds are all from the winter home of the species, and thirty birds have reached me in the flesh. These I have weighed and measured, and have made photographs of a few, showing the "peculiar" and "characteristic" markings of this fine bird.

Several years ago I noticed the plate of Harlan's Hawk by Audubon, and compared the figures with his description in the Ornithological Biography, 1831, pp. 442 and 443. He described an adult male (Birds of America, Pl. 86, Fig. 1) as having the tail "rather narrowly barred with brownish black." None of our adult birds have barred tails, so I agree with Taverner[1] that this bird was an immature one, probably a redtail. Audubon does not describe the adult female (Fig. 2 on same plate) but says that it resembles the male and measures twenty-two inches, which is about the same as twenty-two females measured by me in the flesh. I have examined Plate 86 carefully and find neither male nor female in adult plumage. I believe both are melanistic redtails. Both have the tails barred and both are entirely without white spots. Certainly neither one is the type as described by Sharpe. (In the British Catalogue of Birds, Vol. 1, 1874, p. 191).

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*Read at the Detroit meeting, 1931, of the American Ornithologists' Union.

[1]Bulletin 48, Victoria Memorial Museum, p. 10. Ottawa, 1927.

FIG. 18. An adult male melanistic Red-tailed Hawk from northwestern Arkansas. January 14, 1929.

FIG. 19. An adult male melanistic Red-tailed Hawk from northwestern Arkansas. January 14, 1929. This is the under surface of the specimen shown above (Fig. 18).

No sex is given, but by the measurements and description it is a female Harlan's Hawk (not Fig. 2, as painted by Audubon, however). This type specimen described by Sharpe is very like several in our collection. Mr. J. H. Fleming has written me that he has examined this type in the British Museum, and that it is no doubt a (so-called) Harlan's Hawk.

We must therefore accept Taverner's theory of a mistake or accident in the history of the British specimen, but I, for one, can not accept his theory that *harlani* and *calurus* are the same. He regards *harlani* as a melanistic redtail. Now, in our Museum collection we have twenty birds in this phase of plumage ranging from pure brownish black to a mixture of reddish black, but all have no white in the plumage except at base of feathers on head and nape (Fig. 18 and 19), while *harlani* has white spots both above and below, often from bill to feet (Fig. 20). In melanistic redtails, the adult birds have the red (more or less) barred tail, while adult Harlan's Hawks have the tail streaked and spotted (Fig. 21), never red barred. Immature Harlan's Hawks with barred tails have usually the same black and white spotted plumage (Fig. 22), in strong contrast to the brownish black of immature redtails. Ridgway (Ornithology of Illinois, 1889, pp. 469-471) gives the best description of Harlan's Hawk I have found, both light and dark phases. Of the tails of immature birds he says, "The black bars are wider and decidedly zigzag and oblique."[2] An immature female taken January 25, 1931, in northwestern Arkansas, has two new outside rectrices on one side and three on the other, while the balance are barred with the wavy or U-shaped black bars characteristic of immature Harlan's Hawks (Fig. 23). There are others also in the collection that show this change of tail coloration from immature to adult. In handling these birds in the flesh I noticed a great difference in the markings of the under side of the wings. Harlan's Hawks are more extensively mottled and streaked than redtails. This is also true of the axillaries, which in *harlani* are blackish, while in redtails they are brown (Fig. 24). Figure 25 is a Western Red-tailed Hawk. Figure 26 is a typical adult male of *harlani* taken in northwestern Arkansas on February 26, 1929.

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[2]Ridgway says, "Plumage of flanks, tibia, and crissum remarkably lengthened and lax, the latter reaching within two inches of the tip of tail, and the tibial plumes reaching to the base of the toes."

I find these characters very constant in most of our specimens.

FIG. 20. An adult male Harlan's Hawk taken in southwestern Missouri, January 22, 1929. Ventral aspect.

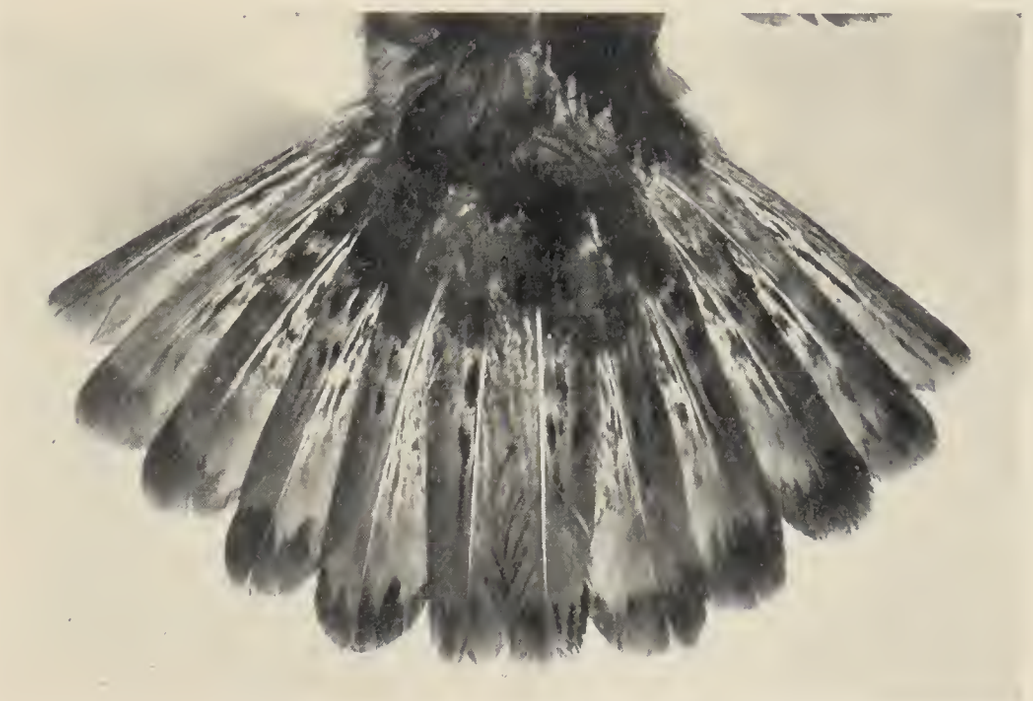

FIG. 21. Upper surface of the tail of an adult male Harlan's Hawk, taken in northwestern Arkansas, January 1, 1929.

FIG. 22. Immature female Harlan's Hawk taken in Benton County, Arkansas, January 18, 1929. Ventral aspect.

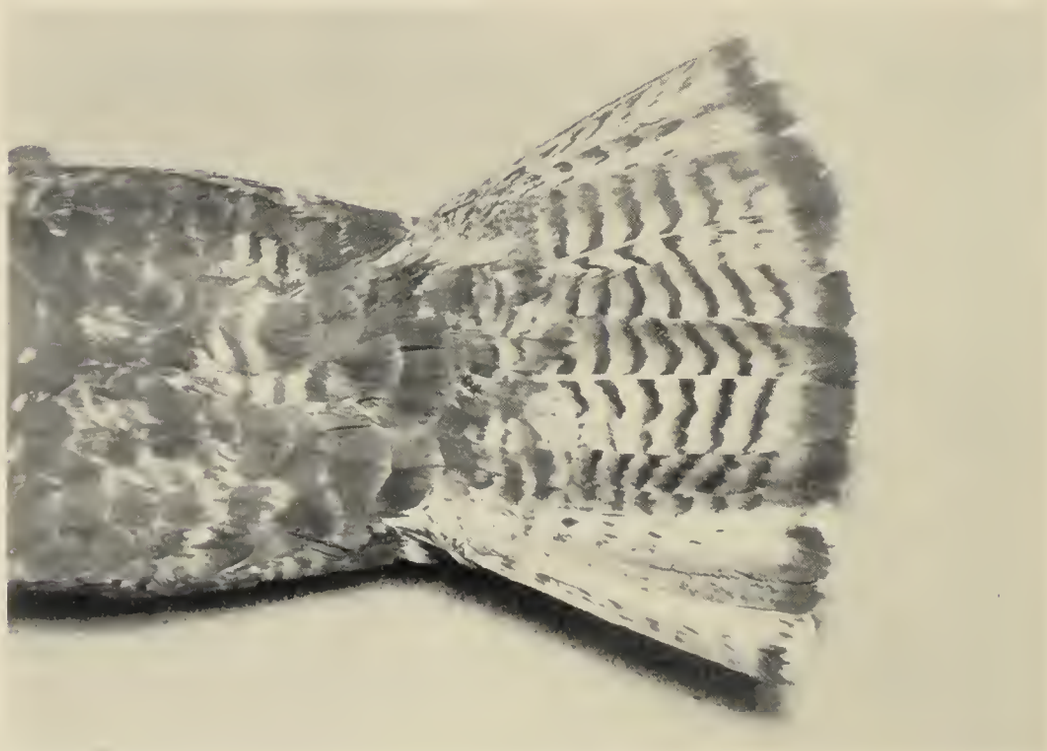

FIG. 23. Upper surface of the tail of an immature female Harlan's Hawk taken at Pea Ridge, Arkansas, January 25, 1931.

FIG. 24. Axillaries of Harlan's Hawk.

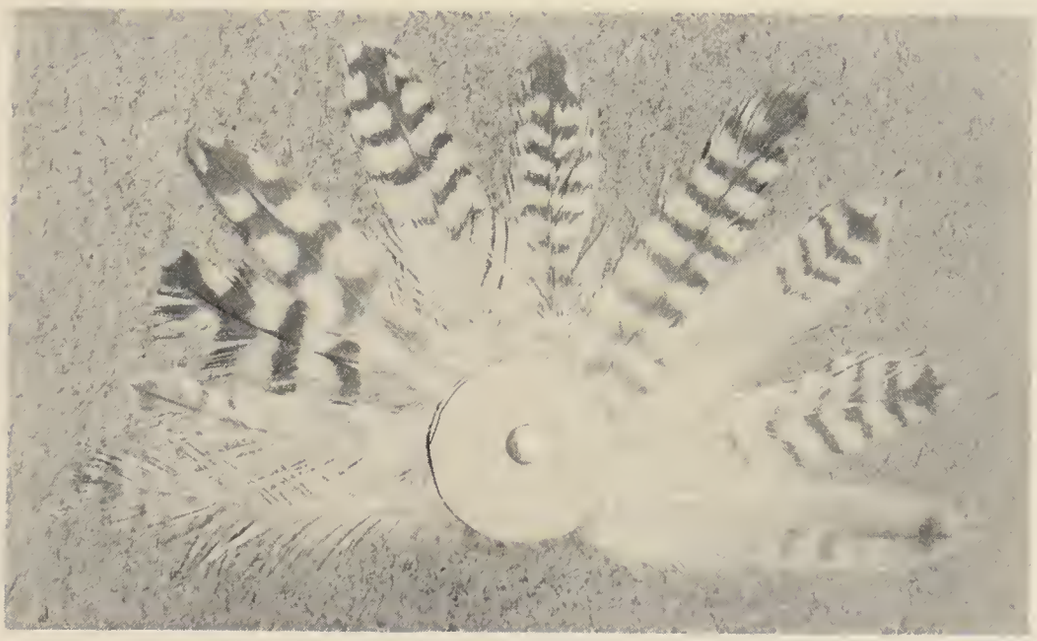

FIG. 25. Axillaries of the Western Red-tailed Hawk.

Table I. Comparative Weights and Measurements

	Harlani No. spec.	*Harlani* Lbs.	*Borealis* No. spec.	*Borealis* Lbs.	Difference
Average weight of female hawks	10	3.25	7	2.75	8 oz.
Average weight of male hawks	17	2 25	11	2.00	4 oz.
		Inches		Inches	
Average length female hawks	10	22.50	7	22.00	.5 in.
Average length male hawks	14	20.75	5	20.50	.25 in.
Average length female wings	36	16.25	61	15.75	.5 in.
Average length male wings	28	15.50	29	14.75	.75 in.
Average length female tails	37	9.75	61	9.00	.75 in.
Average length male tails	48	9.25	29	9.00	.25 in.
Average length female tarsus	30	3.38	49	3.42	.04 in.
Average length male tarsus	60	3.37	57	3.45	.08 in.

The measurements of length are all from birds in the flesh, all from birds taken in winter quarters, and all from birds in good condition—some of them being fat. Harlan's Hawk is somewhat larger and heavier than the redtail.

Harlan's Hawk has a light phase; at least, we have seven in our collection that have much the same pattern of coloration as some redtails, but the markings are black and the tails of all adults (6) are mottled and streaked, in fact typical *harlani* in that respect. Ridgway (Birds of Illinois, 1889, p. 469) describes this phase, and Taverner (*Op. cit.*, Pl. III, Fig. 6) shows a typical photograph of this phase. Figure 8 of his same plate is drawn from Audubon's plate of the "Black Warrior or Harlan's", as described. As I have mentioned before, this bird is a pure immature melanistic redtail. Prof. G. Eifrig (Wilson Bulletin. Vol. XL, No. 4, 1928, pp. 216-218) has an article "On the Status of Harlan's Hawk". He gives several reasons for the belief that Harlan's Hawk is a distinct subspecies. However, his reasons were based on a very small number of specimens, and some of them will not hold. He says, first, there is much more white in the plumage of Harlan's Hawk than in the redtail. Yes, this is one of its chief characters. Second, he says there is no brown on breast and belly in *harlani;* this does not hold for all specimens. Third, he says there is an utter lack of barring on the tibial feathers in *harlani.* In fact in nearly all of Harlan's Hawks the tibia is spotted or barred, often with reddish brown. Fourth, he says the tail of *harlani* is decidedly different from that of *calurus.* This I believe is the chief distinguishing character. In adult of Harlan's Hawk the tail is spotted and streaked, but never red-barred. However, there is quite a variation in the color of the tail, more even than in the body color.

Its winter range includes a territory embracing all of Arkansas, southern Missouri, Oklahoma, and northern Texas, according to Mr.

D. R. Gipple, one of our collectors, who says, "I trap these birds on the ground, using opossum and rabbit for bait, and I see an average of from five to seven a day from the last of October to the middle of April. They seem to feed mostly on rabbits and quail and more or less on the smaller birds of all kinds." Mr. Clyde Day, our other collector, says, "These hawks seem to make their winter quarters in a strip about 100 miles north and south and 300 miles east and west. I see on an average ten a day, half of them Harlan's." Both men say

FIG. 26. Adult male Harlan's Hawk taken in northwestern Arkansas, February 26, 1929. Ventral aspect.

they have never seen a Harlan's Hawk nesting in that region, but many redtails nest there. Mr. H. V. Williams, of Grafton, northeastern North Dakota, who has collected in that region for many years, says he has never seen Harlan's Hawk except during their migration north in April and May (dates April 3 to May 6), and the migration south in September, October, and November (dates, September 28 to November 20). He says, "They are a decidedly larger and heavier bird (very noticeable in the flesh) and the general markings are different." Mr. Williams has collected fifty or more of these birds and is in a position to know them well. He says the flight usually starts with a few stragglers, and gradually increases to its height (about 200 birds

for a day or so), then gradually decreases. He says, "I see usually from 700 to 1000 every spring and fall. They fly with the redtails and circle the same way, usually very high, but after the first few days a number of them stop to feed, but are very shy and wild." We have a specimen from Cherry County, northern Nebraska, November 12, 1925; and a specimen from Hamilton, in southeastern Kansas, November 22, 1924.

Swarth[3] says, "Breeds in extreme northern Bristish Columbia, east of the coast ranges, north into the valley of the Yukon, and eastward for an undetermined distance, migrates southward east of the Rocky Mountains, through the Mississippi Valley, to a winter home in the Gulf states." In fact its normal winter range is well to the north of the gulf region. There are few records east of the Mississippi River. On April 12, 1893, Mr. Albert Lano collected a female near Madison, Minnesota, near the Red River (*Auk*, XIII, p. 342). Robert Ridgway records "a fine adult male of this rare species. It was taken by Mr. Chas. K. Worthen near Warsaw, Hancock County, in March, 1879," (Ornithology of Illinois, Part I, p. 472). F. Woodruff records "one shot near Calumet Lake, Chicago, October 1, 1895." (Birds of the Chicago Area, 1907, p. 95). In "Birds of Indiana", A. M. Butler, in the Report of the State Geologist for 1897, p. 784, says, "accidental visitor. Mr. R. B. Williams, Lebanon, Indiana, has a fine specimen of this hawk, shot in September, 1887, in Boone County, Indiana. This is the first record of the black hawk from Indiana. The well-known Indian chief, Black Hawk, was probably named after this bird." Taverner quotes Dr. L. B. Bishop, who says, "I collected a fine old male *krideri?* in worn breeding plumage, but with a fresh *harlani* tail, near Rolla, North Dakota, July 24, 1901." This might possibly have been a breeding bird, as this is only twenty miles south of the U. S. boundary line. Swarth, 1926, p. 108, says, "I cannot find, though, that there are definite published accounts of the breeding of *harlani* in any region whatever." He overlooked the account of Charles R. Keyes in *The Warbler*, Vol. III, 1907, pp. 41-45, who described the breeding of Harlan's Hawk in Iowa County, Iowa, near Amana. A pair of the birds nested in the same woods for five years in succession, and the first set of eggs was taken April 21, 1898; then Set No. 2 on April 24, 1899; Set No. 3, April 9, 1900; Set No. 4, March 29, 1901; and Set No. 5 on April 10, 1902, from the same tree and nest as Set No. 1. Photographs of three of the sets accompany this paper. Three of

[3]Report on a collection of birds and mammals from the Atlin region, northern British Columbia. Univ. Calif. Publ. Zool., Vol. 30, No. 4, 1926, pp. 51-162.

these sets were in the John Lewis Childs collection. He says the nests were placed from thirty to thirty-two feet above ground, and "it will be seen from the above that the nidification of Harlan's Hawk differs quite naturally from the typical instances of the Red-tailed Hawk, the nest being placed at so low an elevation and without the commanding view . . . the latter species prefers. The eggs, too, are readily distinguishable from a typical series of Red-tails." Later one of these hawks was shot at the nest and was identified by Mr. Brown as "Harlan's Hawk in the melanistic phase of plumage." This is the most southern locality from which this species has been recorded as breeding, and while it was possibly Harlan's, it may have been only a melanistic redtail.

Swarth (1926, p. 110) says, "The most I can claim for the facts here adduced is that they are corroborative of the idea of *Buteo b. harlani* being a geographic race rather than a color phase," while my work on these birds tends to show that color is one of the constant and chief differences between it and the redtails.

My study of this species was finished in the winter of 1931, and this paper was written at this time. The result of my study convinced me that "*harlani*" was entitled to a specific place in the check-list and when "The Check List of the Birds of the World" came out I was glad to see that Peters had arrived at the same conclusion and had given the species its proper name and place.

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SNAKES VERSUS BIRDS; BIRDS VERSUS SNAKES

BY J. E. GUTHRIE

"But when I found myself on the ground, I speedily untied the knot, and had scarcely done so, when the roc, having taken up a serpent of a monstrous length in her bill, flew away. I could not view without terror a great number of serpents, so monstrous that the least of them was capable of swallowing an elephant. They retired in the daytime to their dens, where they hid themselves from the roc, their enemy, and came out only in the night." From The Second Voyage of Sindbad, "Arabian Nights". Ingersoll (65, p. 200).

"Between the eagle and the dragon there is constant enmity, the eagle seeking to kill it, and the dragon breaks all the eagles' eggs it can find; and hearing the noise of the eagle in the air, speedeth to its den, and there hides himself." Cruden's Concordance, 1737 (p. 152).

"By them there sat the loving pellican
Whose young ones poisoned by the serpent's sting,
With her own blood again to life doth bring."

Noah's Flood. Michael Drayton in "Birds in Legend, Fable and Folklore" (65, p. 59).

Quoting further from Ingersoll (65, p. 24): "Whatever tradition or superstition or other motive affected the choice of a bird as a tribal totem, or endowed it with sacredness, practical considerations were surely influential. It is noticeable that the venerated ibis and hawk in Egypt were useful to the people as devourers of vermin—young crocodiles, poisonous snakes, grain-eating mice, and so forth. A tradition in the Aegean island Tenos is that Poseidon, a Greek St. Patrick, sent storks to clear the island of snakes, which originally were numerous there. Australian frontiersmen preserve the big kingfisher dubbed laughing-jackass for the same good reason."

Ingersoll (65, p. 39) recounts how "the Aztecs moved into the valley of Mexico and settled upon certain islets in a marshy lake—the site of the subsequent City of Mexico; and this safe site is said to have been pointed out to them by a sign from their gods—an eagle perched upon a prickly-pear cactus, the nopal, in the act of strangling a serpent. Cortez engraved it upon his Great Seal, and Mexico has kept it to this day."

Someone has said: "A bird is but a glorified reptile", and the Mayas of Yucatan guarded their great temple with stone statues of feather-decked rattlesnakes representing their deity Huitzilopochtli or Kukulcan—surely a glorified reptile!

Naturally, the main relation between birds and snakes is a food-relation. Snakes are meat and birds are meat. Snakes are carnivorous and so are many birds, very few birds being entirely vegetarian. Some snakes eat eggs and so do some birds. Some snakes and some birds compete among themselves and with each other for items in the same food supply. If the heron spears the frog, the water snake goes hungry; if the bull snake seizes the mouse, the hawk dines elsewhere. The garter snake dozes away the morning, digesting his supper of earthworms while the early bird hunts just that much harder for a cropful. Mrs. Mary L. Bailey (6, p. 221) even witnessed a spirited battle between an American Bittern and a snake, judged to be a garter snake, for the possession of a frog which both had seized. The bird got the lunch. And we may go even deeper; for the mouse that would have eaten the weed seeds is the prey of a milk snake, and the Song Sparrow converts those very seeds into songs. It might make life interesting to a cricket to speculate whether a young blue racer will seize him, or whether he will be stuffed down the hunger-well of a nestling meadowlark. Moreover, sometimes the scaly and the feathery beings have common enemies. A garter snake, a chickadee, a mouse and a grasshopper might easily find themselves close neighbors—centrally located in a henhawk.

Before going more specifically into these food relations, let us look at a touching instance of devotion, in which the serpent even gives the coat off his back for the comfort of the others' bairns. It is *Myriarchus crinitus boreus*, of course, that "Wild Irishman of the fly-catchers" as the Sage of Slabsides called the Northern Crested Fly-catcher, who is the best known "ol'-clo'es man"—he and some cousins of his. Alexander Wilson (120, Vol. 2, p. 134) says: "Snake skins with this bird appear to be an indispensable article, for I have never yet found one of his nests without this material forming a part of it. Whether he surrounds his nest thus by way of *terrorem*, to prevent other birds or animals from entering, or whether he finds its silky softness suitable for his young is uncertain; the fact however is notorious." In speaking of the several species of birds which bed themselves with snake sloughs, Finn (41, p. 113) says: "All of the birds with this liking for snakes' old clothes breed in holes, and it has been suggested that the slough is used to terrify intrusive lizards, which are no friends to eggs and young birds, and are themselves preyed upon by snakes." Strecker (111, p. 506) apparently disproves this supposition by listing among fourteen snake-skin users, eight which nest in holes, one which usually does and five which do not. Dugmore (38,

p. 106) remarks of the same bird's home: "Nest in a hollow in a tree, it is rather bulky composed of grasses, weeds, feathers, and frequently castoff snake skins." Davie (34, p. 241) speaks of the nest of the Arizona Crested Flycatcher, *Myiarchus tyrannulus magister*, as being "entirely similar to that of *M. crinitus* even to the traditional snake skins." Of the Mexican Crested Flycatcher, *Myiarchus tyrannulus nelsoni*: "With one exception no snake skins were used in the construction of any of the nests." Also noted by Merrill (81, pp. 118-173). According to Chapman (27, p. 124) Lieut. Wirt Robinson has discovered that one of the commonest and most generally distributed species of the genus in South America places cast snake-skins in its nest. The habit is therefore widespread and is common to birds living under greatly varying conditions. Myers (85, p. 78), describing nest linings of *Myiarchus cinerascens cinerascens*, comments: "Occasionally snake skins, but these are not so frequently used as by the eastern birds." Strecker (111, pp. 501-507) has collected written records and has observed widely concerning this use of cast snake skins. He mentions, besides the flycatchers already referred to, the Eastern and Western Blue Grosbeaks, *Guiraca caerulea caerulea* and *Guiraca caerulea interfusa*, the Gray-tailed Cardinal, *Richmondena cardinalis canicauda*, a single instance of the English Sparrow, *Passer domesticus domesticus*, and four instances of the Carolina Wren, *Thryothorus ludovicianus*. One of these, Abbott (1, p. 158), was in New Jersey. Of the Black-crested Titmouse he says: "A description of the nest of this species would be incomplete without mention of the 'casts'." The road-runner, *Geococcyx californianus*, shows also this habit according to Jaeger (66, p. 13) and Bailey (5). Hume (61, p. 72), mentioned also by Strecker, mentions the Bank Mynah, *Acridotheres gingianus*, as using "feathers, grass and scraps of snake skins." Hume (61, pp. 77-79) also remarks the same habit in the two robins of India, viz., the Brown-backed Indian Robin, *Thamnobia cambaiensis*, and the Black-backed Indian Robin, *Thamnobia fulicata*. Whitaker (119, p. 74) finds the Rufous Warbler building snake skins into its home. And now, if only snakes would build themselves nests of birds' feathers! Snakes have been found in hens' nests, of course, which is not surprising when one considers how fond a serpent is of that warmth which Mother Nature has denied it in its own right. A considerable number of instances have come to our attention in newspaper clippings and otherwise. In one case, Tessman (newspaper item), it was a rattlesnake, and the hen was dead when found, the assassin coiled beneath her body. A parallel case is on record. Cameron (26, p. 383), of a

viper found in the nest of a Buzzard, *Buteo vulgaris*. In this instance, noted from Pomerania, the living viper was found beneath the dead body of the female Buzzard. Sometimes it has been bull snakes or other snakes which may have come because they were egg-hungry.

Snakes Eat Birds

In dealing with the direct food relations between these two classes of animals we shall first consider snakes as the eaters. Some birds and some snakes consume eggs. All birds and some snakes lay them. Advantage goes to the snake, however, for her eggs are usually better concealed. To offset this, the caciques, icterine birds allied to the orioles, weave pendant nests a yard long, apparently to ensure safety from monkeys and snakes. An instance is recorded by Blanchard (18, p. 48) in which a captive milk snake ate even the eggs of a ring-neck snake. Two tropical, egg-eating snakes are so specialized for this egg diet that ventrally projecting blades from the neck vertebrae slit the shells of birds' eggs that are being swallowed. Did the man who invented the band-cutter on the threshing machine know about this, we wonder! In Boulenger's Fauna of British India (22, p. 393) we read concerning the genus *Elachistodon*: "As in the African genus *Dasypeltis*, each of the anterior vertebrae has the hypapophysis or inferior process much elongate, toothlike, capped with enamel and penetrating the walls of the oesophagus." It has been observed that the African snakes feed on eggs, (Wood, 122, III, p. 135) "which are broken in passing along this series of processes, and having arrived so far down the gullet that the mouth can be closed, none of the contents are lost. The same is doubtless the case with *Elachistodon*."

The process of engulfing an egg is an interesting one to watch, whether it is by a milk snake or young bull snake swallowing a sparrow's egg, or a full-grown pilot blacksnake taking down a hen's egg. The egg is approached, touched delicately with the tips of the exquisitely sensitive tongue, and the diner is satisfied that it is desirable food. (How can a young snake know what is going to be inside his first egg? Ask Nature!). The snake now often moves about, stretches its jaws, does various things before actually beginning the swallowing process. Why? Perhaps its imagination is setting its salivary glands at work secreting the large amount of saliva necessary as a lubricant. The snake does not lick over its prey—egg, bird, or mouse—to make it slippery before beginning its meal. An egg is a difficult object to get into the mouth; it is so big, round and smooth, and so hard. John Cole, of Wisconsin, told the writer that his father had known a bull snake in Iowa to visit a turkey's nest daily and swallow the freshly

laid egg. The jaws are pushed over it as the egg is pressed against some convenient object or even against the snake's own coils. Advancing right and left sides alternately its jaws literally crawl over the mouthful. When it is past the head, the muscles of the neck contract and pull it down. After passing down perhaps a foot (in a five-foot snake), the muscles are powerfully tightened and the rough lower ridges of the vertebrae brought to bear on the egg so that the shell gives way. Some snakes are said to swallow the egg whole all the way down and to rely on the digestive juices to dissolve the shell in the stomach. Snakes are sometimes over-eager nest robbers, as witness the note by Holt (58) describing the swallowing of a stone nest egg by a pilot snake, *Elaphe obsoleta*. Another snake, a bull snake, is also referred to by Trine (117, p. 4) as having swallowed a glass one. Several episodes are reported of the persistence of snakes after they had once located a nest of eggs. Northup (in 86, p. 330) drove a blue racer out of a bush in which it was caught in the act of taking an egg from the nest of a Red-winged Blackbird. Thirty minutes later the bird's cries of distress drew the observer back to the nest where he again found the racer. Seiler (103, p. 189) discovered a large bull snake which was climbing the tree containing a wren's nest. She frightened the intruder away. It soon returned and was found with its head inside the entrance of the wren house. One more such instance: Spencer (106, pp. 108-110) records the attack of a black racer on a Catbird's nest in a huckleberry bush. Having eaten all but two of the young birds, it was driven away but was soon back for another, and a little later returned for the last survivor. This observer also found that the eggs of a Bob-white, placed under a hen for hatching, were disappearing, with a great commotion by the foster-mother every time one was taken. When the last one disappeared he saw a great black snake gliding off through the grass.

Some species of snakes confine themselves to cold-blooded prey. Ditmars (37, p. 249) says: "Water snakes do not eat birds," and of garter snakes, Ditmars (36, p. 246): "Adult garter snakes feed principally upon frogs, toads, and earthworms—never upon warm-blooded prey." This statement agrees with the experience of the writer. Guthrie (55, p. 186), who has had scores of garter snakes in captivity and has yet to see one consume or even kill a bird or mouse, or eat a bird's egg. Esther E. Gilmore (52) working at the University of Michigan Biological Station in 1930 tried repeatedly to get garter snakes to eat living and dead birds and birds' eggs. The only success she had was in using a kinglet with wings and tail clipped off. A

garter snake, *Thamnophis sirtalis*, was finally induced to swallow it.

Garter snakes do eat birds occasionally, however, for we have the word of several good observers on this point. Gabrielson (48, p. 137) saw a garter snake swallow the last of nine eggs in a Bobolink's nest in Iowa. Ruthven (97, p. 13) says of garter snakes, genus *Thamnophis*: "On the dryer uplands they have been observed to eat . . . fledgling birds. While in captivity it seems to be impossible to get them to eat dead food, but in the wild state specimens of three species (*sirtalis, radix, elegans*) have been observed to eat . . . birds that had been dead for a considerable time." The writer has had several garter snakes in captivity that came after a time to accept dead frogs or pieces of any kind of meat. Branson (23, p. 377) mentions a case where a western hognose snake, *Heterodon nasicus*, ate a dead Western Meadowlark. Some snakes such as the grass snake, *Liopeltis vernalis*, the red-bellied snake, *Storeria occipito-maculata*, and De Kay's snake, *Storeria dekayi*, as well as the tiny worm-snakes of the genus *Carphophis* are too small to eat birds, even if they cared for warm-blooded prey.

Of the bull snake, *Pituophis*, Ditmars (37, p. 319) says it "is particularly fond of eggs, and consumes them entire, breaking the shells in the throat by a contraction of the muscles. The writer witnessed an illustration of the voracity of one of these creatures. It swallowed fourteen hens' eggs, breaking the shell of each after the egg had passed about a foot down the throat. The demonstration closed by the supply of eggs becoming exhausted and not from any indifference on the reptile's part." Many large bull snakes in the author's cages could not be induced to eat hen's eggs at all, and others only occasionally.

As to the eating of birds by snakes, probably any snake that eats eggs will as readily eat the young birds, or even the old birds if of the proper size, and if it can catch them. The young are helpless and cannot escape, but the parents usually do unless surprised on the nest, bird-charming stories to the contrary, notwithstanding. Of the food of the copperhead, Ditmars (37, p. 422) also writes: "Here these snakes find abundance of food in the shape of birds, small rodents, and frogs. During the late spring these snakes prefer young birds, showing in fact such a decided preference to this food that some snakes will fast unless provided with the feathered prey."

The ways in which snakes catch birds are varied and interesting. With helpless nestlings and eggs, of course, the marauder usually has an easy time of it, as nests are often placed on the ground or in low

bushes. Van Denburgh writes (Blanchard 19, p. 78) of the Boyle's king snake, *Lampropeltis getulus boylii*: "I have twice found it swallowing the contents of quails' nests, and once observed one crawling along the ground, and looking up into the bushes for nests of small birds. Several times while I watched, its quick eyes detected nests three or four feet above it, but although the snake immediately climbed up to these, it did not obtain a meal, for the nests which it examined had been abandoned by their builders or robbed by some earlier comer." Director Edgar R. Harlan of the Iowa Historical Society Museum, told the writer that he once shot a pilot snake while it "was investigating a flicker's nest about sixty feet from the ground." Sometimes the parent birds become militant in defense of their homes. Dr. T. C. Stephens mentions (in correspondence) a case in which a female Brown Thrasher fought an intruding snake. Birds of other species than those molested frequently gather about an attacking snake and try to scold it to death. Results negative.

The usual method of capture is by a quick dart of the head—a snake's lunge is almost unbelievably swift—and the victim is seized by the nearest corner, head, body, leg, wing; the serpent sometimes getting only a mouthful of wing or tail feathers. The writer has observed that when a rattlesnake strikes a mouse or ground squirrel or rat it usually sinks its fangs with their charge of venom, then retreats to a little distance to await the victim's death. With an English Sparrow, however, the rattler seldom lets go after the stroke but holds on until the poison has done its work. As a snake could not follow its wounded prey by the air route it probably saves not a few meals by this habit. Of course the non-venomous bird-eaters retain their hold until the captured prey is either killed—in the case of such constrictors as the bull snake, fox snake, or pilot snake—or until it gets the living prey jockeyed around into swallowing position—in case of a racer or coach-whip. As to how the bird is approached or attracted near enough to be taken there seems to be some doubt. Probably such an inconspicuous object as a snake, fitting so well into the lines and colors of its surroundings, may often be accidentally approached by a hapless bird which does not realize the presence of the danger until too late. Probably, also, the noiseless reptile occasionally sneaks up successfully while its intended quarry is otherwise occupied. It is interesting to know that from the same Anglo-Saxon word *snican*, to creep, came the two words, snake and sneak.

The question of the occult influence which a snake's mind is popularly supposed to exert on the mind of the bird is a matter of spirited debate. Over a century ago, James E. DeKay observed (35, p. 57): "The absurd notion of fascination is entertained by few at the present day." Psychologists versed in the lore of mind, and knowing how much inferior is the reptile brain to that of its avian prey deny this power to the snake—and one cannot doubt that men who have observed snakes for half a life time and studied them understandingly, would be likely to be on the lookout for and would notice any evidence of this phenomenon. Such men almost universally express their disbelief in any such occurrence in nature. The writer has had many bird-eating snakes—rattlers, fox snakes, bull snakes, pilot snakes, whip-snakes, blacksnakes, blue racers, king snakes, and boas. He has seen a sparrow peck at a rattlesnake's nose and ride around on the coils of a writhing rattler or bull snake. There was usually no evidence of fear unless the snake lunged, and never a sign of that paralysis supposed to hold the victim immovable through the baleful glare of the serpent's eye. To be sure, not to have seen such a phenomenon does not prove its impossibility. In explanation of the happenings one often hears recounted one is inclined to think of a fear paralysis such as sometimes is said to hold a man when a locomotive or automobile bears suddenly down upon him. Perhaps, thus, fear is the explanation. Undoubtedly the frantic parents in defense of nest and young sometimes venture too close for safety. Possibly a pugnacious bird in attacking an intruder becomes foolhardy—and rues it. And so, in the face of many hard-to-explain accounts by observers who thus interpreted the things they observed, Mr. H. A. Surface in "The Serpents of Pennsylvania" (114, p. 120) observes: "It is popularly believed that snakes have the power to charm birds and the lower animals and even mankind, but with the most careful investigation, we can not find satisfactory evidences of the truth of this. It is true that some creatures, such as birds, and even some persons, become so terrified at suddenly seeing a snake that they act more or less helpless, but this is quite different from being charmed."

Max Morse in Batrachians and Reptiles of Ohio (84, p. 100) remarks: "So many superstitions are associated with these forms of animal life that it would be impossible to cover them in this paper, to say nothing of attempting to disprove them. As classic examples we may cite . . . the charming power of snakes. It is needless to say that all these are myths." In "the Poisonous Snakes of North America" (108, pp. 292-293) Dr. Leonard Stejneger reviews the evidence con-

cerning "charming" thus: "The popular belief in the power of the poisonous snake to 'charm' its victims into a state of helplessness is by no means exterminated. In spite of all that has been argued and explained against it there are people still who profess to have ocular proof of this power. Time and again it has been related by trustworthy observers how birds or small mammals have been seen to approach the coiled snake, drawn toward it as if by a magic spell they were unable to withstand, etc. There is evidently enough truth in the numberless observations of this nature to keep the scientist busy trying to evolve a theory by which to explain so much of the stories as appeared worthy of being admitted as facts." D. Humphreys Storer in Reptiles of Massachusetts (112, p. 234) writes of the rattlesnakes, *Crotalus*: "The power of fascination attributed to this genus is too absurd to require our serious consideration." Another authority on reptiles, E. D. Cope (29, pp. 713-714) explains thus: "Snakes are popularly believed to possess the power of 'charming' or attracting to themselves other animals, especially birds, against their will, so that they easily capture them for food. This belief rests on a habit which is usual among the smaller birds of annoying other animals which they dislike or fear. Every one knows how they will congregate about an owl which has not sufficiently concealed itself by daylight and will make their hostility known by cries and efforts to strike their enemy. I have witnessed a crowd of birds collected about a black snake, which displayed their hostility by many cries and movements, the snake the while eying them with an inactive interest. Should one of the birds venture too near, I strongly suspect that the snake would take advantage of the opportunity to secure a meal, but this I have not witnessed. I believe, however, that the stories of 'charming' are due to an observation of this not uncommon experience of the field naturalist." In his account of the Boomslange (tree-snake), *Bucephalus capensis*, Wood states (122, p. 136): "The Boomslange is generally found in trees, to which it resorts for the purpose of catching birds, upon which it delights to feed. The presence of a specimen in a tree is generally soon discovered by the birds of the neighborhood, who collect around it and fly to and fro, uttering the most piercing cries, until some one, more terror-stricken than the rest, actually scans its lips, and almost without resistance, becomes a meal for its enemy." Dr. S. Weir Mitchell (82, p.), who had unexcelled opportunities for observation, wrote of the way in which birds and small animals behaved fearlessly when introduced into a cage with rattlesnakes and often came to live intimately with them. He concluded: "These are the sole

facts which I have seen bearing any relation to the supposed fascinating faculty. They appear to me to lend no strength to the idea of its existence."

And Birds Devour Snakes

So far as the literature goes the writer has found no record of birds having consumed the eggs of snakes, though doubtless some of them would do so if they could find them. Some strange instances come to light occasionally in which the most unexpected of birds are snake-eaters. The writer has been told of hens killing and eating green snakes, *Liopeltis vernalis*, in Iowa, and Blatchley (20, p. 549) writes: "I saw a chicken running along the roadside with a squirming snake in its bill. After a sharp chase of the fowl through a rail fence and a blackberry patch, its prey was dropped and proved to be a fine specimen of Storer's snake, *Storeria occipitomaculata*." Crimmins (32, p. 46) says: "I have personally seen chickens kill and eat rattlesnakes." These were young Texas diamond-back rattlers about twelve inches long. Oddly enough, several observations show that Robins sometimes feed them to their nestlings. McIntosh (76, p. 152) found a Robin pecking a thirteen-inch garter snake. The snake was evidently nearly dead when the bird finally managed to pick it up and fly off about seventy-five feet to a post on which one of its young was seated. It tried to feed it to the baby, which, of course, was unable to handle the unwieldy morsel. The snake was dropped to the ground but was picked up later and another futile attempt made to feed it to the young bird. Marshall (80, p. 304) saw a Robin kill a ten-inch garter snake and carry it up into a tree. Being called away he did not see the snake eaten but it was gone when he returned. Friedmann (47, pp. 259-260) once put two young Cowbirds in a Robin's nest. The Robins accepted and reared them and on one occasion he noticed that one of the young Cowbirds had been fed a very young garter snake which it finally swallowed and digested. Mallard Ducks are reported to occasionally eat snakes, (McAtee 78, p. 113), while Hay (56, p. 527) says that turkeys and ducks eat garter snakes. Crimmins (32, p. 47) says chickens and muscovy ducks ate pieces of a young Texas diamond-back rattlesnake, *Crotalus atrox*.

However, these are apparently unusual cases. Some birds which are mainly meat-eaters as shrikes, hawks, herons and the like eat considerable numbers of the scaly prey. Note the name "serpent eagle" applied to members of the genus *Spilornis* in the East Indies and Africa. The harrier eagles, *Batastur*, are also called "serpent eagles" and several kites go by the name of "snake hawks". The shrikes or

butcher birds, besides their usual fare of insects, rodents, and birds have serpents occasionally on their menu. Ditmars (36, p. 274) narrates thus: "During a collecting trip a queer observation was made. A heavy rain had fallen the night before, enticing the burrowing snakes from their hiding places. Evidently the scarlet snakes, *Cemophora coccinea*, had been conspicuous objects during the early morning. On the ends of dead twigs and stems, right and left, were the weird souvenirs of the shrikes or butcher birds, consisting of partially-eaten bodies of snakes. The reptiles were securely fastened by forcing the tip of the twig into the body cavity like a finger into a glove. The shrike is a carnivorous bird, notorious in having eyes too big for its stomach. Its half-eaten prey is thus jauntily deserted."

One would consider venomous sea-snakes safe from attacks of birds, but sea captains of the Molucca and Sunda Straits told Dr. Ditmars (36, p. 289) of having seen albatrosses and frigate birds dragging these serpents from the waves and flying to the rigging of the ship to kill and devour them. South Africa has two animals commonly known as "ringhals". One is a cobra which eats birds and eggs, the other is the white-necked raven which often feeds on snakes. Even the bush kingfisher, *Halcyon*, of Africa, and the "laughing jackass", *Dacelo gigas*, kingfisher of Australia, are snakivorous. The latter, according to Wood (122, p. 170), "catches them by the tail and crushing their heads with its powerful beak . . ." Another observer, Lucas and LeSouef (74, p. 161), describes the execution somewhat differently: "Swooping down from his perch of observation, with his formidable beak the latter (Laughing Jackass) strikes the snake before his own feet reach the ground, breaks the back of the reptile, and so disables it. He will fly up with the snake in his mouth, and then let it drop from a height back to the ground, and repeat this treatment until the snake can be safely swallowed." The ground hornbill, *Bucorax cafer*, subsists partly upon these reptiles as does the ground cuckoo known as Road-runner or chaparral cock of our Pacific coast, renowned in popular belief as being a valiant slayer of rattlesnakes. Naturally, many raptorial birds such as hawks, owls, and buzzards find scaly prey to their taste. Of the wading birds, the Sandhill Crane, *Grus canadensis tabida*, the Great Blue Heron, *Ardea h. herodias*, and the American Bittern, *Botaurus lentiginosus*, are serpent eaters. Klauber (70, p. 13) observes: "Aside from man, the principal enemies of the rattle snakes in this county [San Diego County, California] are birds and other snakes. Eagles, hawks, and owls are sometimes seen carrying rattlers and other snakes in their talons." Blatchley

(20, p. 548) says: "I observed a sparrowhawk fly across a meadow bearing a wriggling snake in its talons. I stepped up behind the thorn tree in which it alighted and giving a sudden whoop caused it to drop its prey, which proved to be an example of *Eutainia* (*Thamnophis*) *sirtalis parietalis*, the red-barred garter snake." Quoting from Barbour (9, p. 28): "Our red-shouldered hawk seems to feed almost exclusively upon snakes, at least in Florida. That curious hawk, the Secretary-bird of South Africa, classified as *Serpentarius secretarius*, eats any and all snakes, as do some of the great heavy-billed storks and ibises which kill their prey with blows of their powerful beaks." W. P. Pycraft (95, p. 115) writes: "The Secretary-bird (*Serpentarius reptilivorus*) of South Africa, from its fondness for poisonous snakes, has during the last few years been rigidly protected by law. Standing nearly four feet in height and of powerful build, this remarkable bird —an aberrant member of the hawk tribe—displays no small skill and caution in attacking its venomous prey, shielding itself by means of the wings and kicking violently with both feet until its victim is vanquished." Sometimes it is said to fly high in the air and kill its prey by dropping it on the rocks. Saintleven (100), in speaking of rattlesnakes in southern Texas, recounts: "Wild turkeys show a great antipathy to them, and never fail to make a direct and persistent attack until the reptile is destroyed." Speaking of an instance which he had witnessed, he tells of watching a large flock of wild turkeys of which the gobblers were engaged in killing a large rattlesnake. "One after another would spring into the air in rapid succession and come down on the reptile which they struck a hard blow with one wing. . . . It is their custom to eat the snakes killed in that way."

Thus between birds and snakes the honors, or dishonors, appear to be rather equally divided. To some species of birds, and to other species at certain seasons, snakes, both venomous and non-venomous, are the preferred normal diet. Other birds of somewhat omnivorous habits so far as animal food goes, get an occasional serpent. A few, Robins for example, may classify small snakes as merely unusually active angleworms and therefore good baby-food.

And with snakes much the same situation exists. Some are inveterate nest yeggs, getting most of their living by this species of burglary. Others catch many birds, both nestling and adult. A few occasionally eat dead birds, even as Crows and buzzards prize a dead snake as highly as a living one.

For practical purposes, for the Middle West, the *Buteo* hawks, especially the Red-tailed Hawk, the Marsh Hawk, and probably to a lesser extent Crows, herons and bitterns are the birds which send a shudder down the sinuous backbones of small snakes. Yet even though these birds take toll of some of our most valuable snakes, their rodent-destroying habits place them safely in the column of our feathered farm friends. And as to our snakes, what shall we say? Probably the pilot blacksnake, an inveterate climber, destroys more birds than any other in its habitat. Branson (23, p. 388) believed this to be the case in Kansas. Bull snakes, fox snakes, and racers get some eggs and young birds, with occasionally an adult. All these snakes are extremely valuable as mousers, ratters, squirrelers, and gopherers; and the blue racer as an insect-eater as well, to be too hastily condemned and summarily executed *en masse* for being "bird-lovers". Our other snakes probably do too little harm to birds to even deserve dishonorable mention.

Following is a list of snake bird-eaters and bird snake-eaters, not at all exhaustive, but suggestive, gathered from what literature was accessible to the writer. A considerable number of the references were kindly suggested by T. C. Stephens.

Snakes Eaten by Birds

In the following list the scientific as well as the common names of both snakes and birds are given when known. Of course, in many cases the species was unknown to the observer, at least the name was not recorded. In other cases the statement found applies to a whole group: as "herons", "hawks", "birds", "birds' eggs", "garter snakes", "colubers", etc. In the numerous cases recorded merely as "reptiles", snakes and lizards or either one of them may have been meant, but they have not been included in this list. It is probable that any birds that would eat lizards would also eat snakes of suitable size; and that snakes which would eat one bird or egg would devour any other of like size if obtainable. Some of the records are of isolated cases, while others indicate a regular food habit. Moreover, some are records of captive specimens, others of observations in the wild; while many have been gained from stomach examinations of collected specimens. It is not always possible from the records to determine which of the above was the case.

Albatrosses eat sea snakes, Boulenger (21).

Water Turkey or Snake Bird, *Anhinga anhinga*, eats snakes, Audubon (4).

Florida Cormorant, *Phalacrocorax auritus floridanus*, ate a water snake, *Natrix*, Pearson (94).

Frigate birds eat sea snakes, Boulenger (21).

Large sea birds eat poisonous sea snakes, Ditmars (36, p. 289).

Mallard Duck, *Anas boschas*, eats small snakes, McAtee (77, p. 10); McAtee (78, p. 113). Rattlesnakes, Crimmins (32, p. 47).

Ducks eat garter snakes, Hay (56, p. 527). Eat *Thamnophis sirtalis*, De Kay (35, p. 45).

Crested Screamer or snake crane, *Chauna cristata*, (of Brazil) fond of snakes as food, McAtee (78).

White Ibis, *Guara alba*, eats snakes, mostly moccasins, *Agkistrodon piscivorus*, Baynard (13).

Glossy Ibis, *Plegadis autumnalis*, eats snakes, mostly moccasins, Baynard (14).

Egyptian Ibis, foe to small snakes, Ingersoll (65, p. 17).

Wood Ibis, Jabiru, *Mycteria americana*, eats snakes, Netting (88, p. 28); Smith (105, p. 59).

Ibises eat snakes, Barbour (9, p. 28).

Storks eat snakes, Barbour (9); Netting (88). Eat ringed snake, *Tropidonotus natrix*, Schmeil (102, p. 240).

American Bittern, *Botaurus lentiginosus*, eats snakes, Barrows (11, p. 128); Howell (59, p. 24). Water-snakes, Netting (88, p. 28).

Great Blue Heron, *Ardea herodias*, eats snakes, Baker (7); Barrows (11, p. 136); Howell (59, p. 25).

American Egret, *Ardea egretta*, eats small water snakes, Wilson and Bonaparte (120, Vol. 2, p. 300). Mostly moccasins, *Agkistrodon piscivorus*, Baynard (13).

Egret, *Ardea* (?) *rufa*, eats snakes, mostly moccasins, *Agkistrodon piscivorus*, Baynard (13).

Snowy Egret eats snakes, mostly moccasins, *Agkistrodon piscivorus*, Baynard (13).

Little Blue Heron, *Ardea caerulea*, eats snakes, Baynard (14). Mostly moccasins, *Agkistrodon piscivorus*, Baynard (13).

Louisiana Heron, *Ardea tricolor ruficollis*, eats snakes, Baker (7).

Green Heron, *Ardea virescens*, eats snakes, Baker (7).

Black-crowned Night Heron, *Nycticorax nycticorax naevius*, eats snakes, Baker (7).

Yellow-crowned Night Heron, *Nyctanassa violaceus*, eats snakes, Baker (7).

Whooping Crane, *Grus americana*, eats snakes, Netting (88, p. 28).

Sandhill Crane, *Grus mexicana*, eats snakes, Barrows (11, p. 150).

Virginia Rail, *Rallus virginianus*, ate a DeKay's snake, *Storeria dekayi*, and a garter snake, *Thamnophis sirtalis*, Cahn (25, p. 94).

Emu, *Droma novae-hollandiae*, eats snakes, Smith (105, p. 59).

Chickens, *Gallus gallus*, ate a red-bellied snake, *Storeria occipitomaculata*, Blatchley (20, p. 549). Garter snakes, *Thamnophis sirtalis*, DeKay (35, p. 45); Crimmins (32, p. 47).

Turkeys, *Meleagris*, eat garter snakes, *Thamnophis* species, Hay (56, p. 527). *Thamnophis sirtalis*, DeKay (35, p. 45); Saintleven (100).

Vultures eat living serpents, Wilson and Bonaparte (120, Vol. 3, p. 325).

Turkey Buzzard, *Cathartes aura*, (nestling) ate a house snake, *Lampropeltis*, Roddy (96, p. 245). Eats snakes, Barrows (11, p. 256).

Black-winged Falcon, *Elanus melanopterus*, eats snakes, Wood (122, p. 63).

Swallow-tailed Kite, snake hawk, *Elanoides forficatus*, eats snakes, Barrows (11, p. 260); Fisher (42); Howell (60, p. 37); Netting (88, p. 28). Seen carrying long, slender snakes, Audubon (4).

Mississippi Kite, *Ictinia mississippiensis*, eats snakes, Barrows (11, p. 261); Howell (60, p. 37); Netting (88, p. 28). Eats rough green-snake, *Opheodrys aestivus*, Wilson and Bonaparte (120, Vol. 1, p. 71).

Kites are large consumers of snakes, Baskett (12, p. 143).

Sharp-shinned Hawk, *Accipiter velox*, only occasionally snakes, Netting, (88, p. 28).

Goshawk, *Astur atricapillus*, only occasionally snakes, Netting (88, p. 28).

Marsh Hawk, *Circus hudsonius*, eats snakes, Fisher (42); Wilson and Bonaparte (120, p. 244); Howell (60, p. 37).

Buzzard, *Buteo*, (an African hawk) eats useful snakes, Fitzsimons (43, Vol. 2, pp. 34-35).

Buzzard, *Buteo vulgaris*, natural enemy of the viper, *Pelias berus*, and ringed snake, *Tropidonotus natrix*, Schmeil (102, p. 240). Snakes, Thorburn (115, p. 80).

Red-tailed Hawk, *Buteo borealis*, nestling ate a spreading adder, *Heterodon contortrix*, Over (91, p. 28). Rattlesnakes, Netting (88, p. 28).

Western Red-tailed Hawk, *Buteo borealis calurus*, eats snakes, Eliot (40, p. 151).

Krider's Hawk, *Buteo borealis krideri*, ate a blue racer, *Coluber constrictor flaviventris*, Gloyd (53, p. 141).

Red-shouldered Hawk, *Buteo lineatus*, eats snakes (almost exclusively in Florida), Barbour (9); Nicholson (90, Vol. 42, p. 35); Eaton (39, Vol. 2, p. 84); Howell (59, p. 39).

White-tailed Hawk, *Buteo albicaudatus sennetti*, eats snakes, Fisher (42).

Swainson's Hawk, *Buteo swainsoni*, occasionally brought snakes for its young. Ate a garter snake, *Thamnophis sirtalis*, and an entire rattlesnake, Cameron (26, p. 174 and pp. 282-283).

Golden Eagle, *Aquila chrysaeëtos*, very partial to snakes, Cameron (26, p. 382); Fisher (42). Prairie rattlesnake, *Crotalus confluentus*, Netting (88, p. 28).

Bald Eagle, American eagle, *Haliaeëtus leucocephalus*, eats snakes, Barrows (11, p. 288).

Jean le blanc Eagle, *Circaetus gallicus*, eats snakes, Wood (122, p. 38).

Eagles eat rattlesnakes and other snakes, Klauber (70, p. 13).

Serpent eagles, genus *Spilornis*, eat snakes, New Internat. Encyc. (89).

Harrier Eagle or serpent eagle, genus *Batastur*, (Asiatic and African) eats snakes, New Internat. Encyc. (89).

Bataleur, *Helotarsus ecaudatus*, (African) eats snakes, New Internat. Encyc. (89).

Jardine's harrier (Australia) very fond of small snakes, Wood (122, p. 94).

Harrier hawk, *Polyboroides*, (African) eats snakes, Fitzsimons (43, Vol. 2, p. 38).

Sparrow Hawk, *Falco sparverius*, ate red-barred garter snake, *Thamnophis sirtalis parietalis*, Blatchley (20, p. 548). Eats small snakes, Wilson and Bonaparte (120, Vol. 1, p. 30); Howell (59, p. 41).

Hawks eat rattlesnakes, genus *Crotalus*, and other snakes, Klauber (70, p. 13). Garter snakes, *Thamnophis*, Hay (56, p. 527). *Thamnophis sirtalis*, DeKay (35, p. 45).

Secretary-bird, serpent eagle, *Serpentarius secretarius*, (Africa) eats snakes, Fitzsimons (43, Vol. 2, pp. 38 and 155); Baskett (12, p. 143); Barbour (9, p. 28); Daglish (33, p. 176). Poisonous snakes, Pycraft (95, p. 115). Eats cobras, three snakes as thick as a man's arm found in one, Wood (122, pp. 89-90).

Screech Owl, *Otus asio asio*, ate young garter snake, Allen (2, p. 6).

Burrowing Owl, *Speotyto cunicularia*, attacks live snakes, eats dead ones, probably eats small rattlesnakes, Netting (88, p. 28).

Burrowing Owl, *Speotyto cunicularia hypogaea*, eats Hammond's garter snake, *Thamnophis ordinoides hammondii*, (body of one photographed in burrow), McLean (79, p. 13).

Owls eat rattlesnakes and other snakes, Klauber (70, p. 13). Garter snakes, Hay (56, p. 527). Garter snake, *Thamnophis sirtalis*, DeKay (35, p. 45).

Road-runner, snake-bird, *Geococcyx californianus*, eats small snakes, Eliot (40, p. 162). Kills rattlesnakes, Myers (85, p. 2). Eats snakes, Barbour (9, p.); Cockerell (28). "Kills and eats rattlesnakes", Saintleven (100).

Ground hornbill, *Bucorax cafer*, (Africa) eats snakes, Fitzsimons (43, Vol. 2, p. 126); Ingersoll (65, p. 16).

Bush kingfisher, *Halycon*, eats snakes, Fitzsimons (43, Vol. 2, p. 24).

Laughing jackass, *Dacelo gigas*, eats snakes, Ingersoll (65, Vol. 2, p. 24); Wood (122, Vol. 2, p. 170).

Rollers, *Coracias* and *Eurostomus*, (Africa) eats snakes, Fitzsimons (43, Vol. 2, p. 22).

Magpie, *Pica pica hudsonica*, killed a rattlesnake, Boulder Daily Camera, Boulder, Colorado, June 4, 1895.

California jay, *Aphelocoma californica*, eats snakes, Beal (15).

Crow, *Corvus brachyrhynchos*, eats snakes, Barrows (11, pp. 424-425). Harmless snakes, Barrows and Schwartz (10, pp. 49-50). Milk snake, *Lampropeltis*, Wilson (121, p. 124).

Pied crow, *Corvus scapulatus*, (Africa) eats snakes, Fitzsimons (43, Vol. 2, p. 1).

White-necked raven, ringhals, *Corvulture albicollis*, eats snakes, Fitzsimons (43, Vol. 2, p. 1); Wilson (121, p. 124).

Cowbird, *Molothrus ater*, nestling ate garter snake, Friedmann (47, p. 270).

Northern Shrike, *Lanius borealis*, eats snakes, Blanchan (17).

Loggerhead Shrike, *Lanius ludovicianus*, killed garter snake, ate DeKay's snakes, *Storeria dekayi*, Judd (67, pp. 100, 102). Eats snakes, garter snake, *Thamnophis sirtalis*, and a snake of the genus *Lepthophis*, impales snakes on barbed-wire fence, Judd (68, p. 21).

White-rumped Shrike, *Lanius ludovicianus excubitorides*, eats snakes, Cockerell (28).

Migrant Shrike, *Lanius ludovicianus migrans*, eats small snakes, Barrows (11, p. 563).

Shrike attacked a snake, Gignoux (51, p. 75).

Shrikes ate scarlet snakes, *Cemophora coccinea*, Ditmars (36, p. 274).

Robin, *Planesticus migratorius*, ate garter snake, McIntosh (76, p. 152); Marshall (80, p. 304); Simpson (104). Fed garter snake to nestling cowbird, Friedmann (47, p. 270).

Birds Eaten by Snakes

Massasauga, *Sistrurus catenatus*, eats young birds, Ditmars (37, p. 438). Probably small birds, Atkinson and Netting (3, p. 42); Netting (88, p. 26).

Pigmy rattlesnake, *Sistrurus miliarius*, eats very young birds, Ditmars (37, p. 436); Hurter (63, p. 212).

Banded or timber rattlesnake, *Crotalus horridus*, eats birds, Ditmars (37, p. 446); Netting (88, p. 26); Morse (84, p. 138); Forbush (44, p. 45); Hurter (63, p. 214). Small birds, Wood (122, Vol. 3, p. 101). An occasional bird, Stejneger (108, p. 432).

Rattlesnake (probably *C. horridus*) ate field sparrow, *Spizella pusilla*, and young, Nauman (86, p. 331).

Prairie rattlesnake, *Crotalus confluentus*, eats birds, Ditmars (37, p. 457). Occasionally birds, Over (91, p. 29).

Diamond-back rattlesnake, ate a quail, Stoddard (110).

Western diamond-back rattlesnake, *Crotalus atrox*, eats birds, Ditmars (37, p. 453).

Tiger rattlesnake, *Crotalus tigris*, eats birds, Ditmars (37, p. 460).

Copperhead, *Agkistrodon mokasen*, eats small birds, Ditmars (37, p. 424); Hay (56, p. 532). The smaller disabled birds, DeKay (35, p. 54). Birds, Hurter (63, p. 207); Netting (88, p. 26). Eggs and young, Forbush (44, p. 45). A sparrow, Surface (114 p. 189).

Cotton-mouth moccasin, *Agkistrodon piscivorus*, birds, Ditmars (36, p. 322 and 37, p. 419). Green heron's eggs, *Ardea virescens*, Howell (60, p. 103).

Fer-de-lance, *Bothrops atrox*, coiled up in nest of bird whose eggs or young it had devoured, Wood (122, Vol. 3, p. 98).

Puff adder, *Bitis arietans*, a large bird, Loveridge (73).

Viper, *Pelias berus*, eats birds, Wood (122, Vol. 3, p. 114); Palmer and Westell (93, p. 288).

Viper (in Pomerania) found in nest under dead buzzard, *Buteo vulgaris*, Cameron (26, p. 383).

Horned palm viper, *Lachesis schlegelii*, young birds, Ditmars (36, p. 348).

Ringhals, *Sipedon haemachates*, (a South African cobra) birds and eggs, New Internat. Encyc. (89).

Cobra de capello or hooded cobra, *Naja tripudians*, young poultry and birds, New Internat. Encyc. (89).

Spitting cobra, Black-necked cobra, chickens, struck hen in nest-box, Loveridge (73, pp. 109, 112).

Cobras, birds and eggs, Ditmars (36, p. 297).

Green mamba, *Dendraspis angusticeps*, probably killed black-bellied bishop bird, *Pyromelana nigriventris*, on nest, Loveridge (73, p. 115).

Genus *Elachistodon*, especially fitted for egg-eating, Boulenger (22, p. 393); Ingersoll (64, p. 57).

Egg-eater, *Dasypeltis scabra*, eggs and nestlings, Fitzsimons (43, Vol. 1, p. 240). Eggs, Wood (122, Vol. 3, p. 135); Forbush (44, p. 41).

Boomslang, *Dispholidus typus*, eggs, young and adults, Fitzsimons (43, Vol. 1, p. 240).

Boomslang, *Bucephalus capensis*, birds, Wood (122, p. 136).

Bird snake, *Theltornis kirtlandii*, eggs, young and adults, Fitzsimons (43, Vol. 1, p. 240).

Spreading adder, *Heterodon contortrix*, bird, Netting (88, p. 26): Surface (114, p. 185). Birds and eggs, Forbush (44, p. 45).

Western hognose, *Heterodon nasicus*, ate adult meadowlark, Branson (23, p. 377).

Blacksnake, black racer, *Coluber constrictor constrictor*, birds, Ditmars (36, p. 255). Birds and eggs, Ditmars (37, p. 282). Birds, eggs and young, DeKay (35, p. 36). Birds 4% of food, birds' eggs 4%. Surface (114, p. 169); Forbush (44, pp. 43-44). Catbird eggs, Morris (83, p. 253); Spencer (106, p. 108). Young catbird, Burroughs (24, pp. 27-30). Wren, quail eggs, Spencer (106, p. 108). Young Florida blue jay, Nicholson (90, Vol. 29, p. 190). Young blue jay, Linsdale (72, p. 557). Small birds, adult robin, Storer (112, p. 226).

Blue racer, *Coluber constrictor flaviventris*, eggs of red-wing blackbird, *Agelaius phoeniceus*, in nest of cardinal, *Cardinalis cardinalis*, eggs of vireo, and of red-winged blackbird, Nauman (86, pp.330, 331). Eggs of bobwhite, *Colinus virginianus*, prairie chicken, *Tympanuchus americanus*, and fowls, Morse (84, p. 128). Birds and eggs, Wood (122, Vol. p. 132); Force (46, p. 31): Netting (88, p. 26).

Racer, *Coluber semilineatus*, young Woodhouse jay, *Cyanocitta woodhouseii*, Stejneger (109, p. 155).

Coachwhip, *Masticophis flagellum frenatum*, small birds, Ruthven (98, p. 576).

Striped racer, *Coluber lateralis*, young house finch, Law (71, p. 179). Racers, genus *Zamensis*, feed principally on mammals and birds. Boulenger, G. A. (22, p. 323).

Coachwhip, *Masticophis flagellum flagellum*, English sparrows, Force (46, p. 30). Birds and eggs, Ditmars (37, p. 287); Hurter (63, p. 173). Attacked a hawk, Wood (122, Vol. 3, p. 132).

Coachwhips, *Masticophis*, birds, Ditmars (37, p. 287); Ditmars (36, p. 257). Young quail, Stoddard (110).

Dryophis prasinus, small birds, Boulenger, G. A. (22, p. 369).

Elaphe spiloides, eggs of guinea fowl, Hurter (63, p. 182).

Emory's coluber, *Elaphe laeta*, small birds, Ditmars (37, p. 299).

Davis Mountain coluber, *Elaphe subocularis*, small birds, Ditmars (37, p. 300).

Corn snake, *Elaphe guttata*, quail, two instances, Ditmars (37, pp. 301-302). Birds, Wood (122, Vol. 3, p. 130).

Pilot blacksnake, *Elaphe obsoleta*, hens' eggs, flickers, quail and other birds, Hurter (63, p. 180). Killed a large horned owl in captivity, Blatchley (20). Birds and eggs, Branson (23, p. 388). Birds' eggs, chickens, robins, red-winged blackbirds, crow blackbird, sparrows, eggs 2%, birds 28% of food, Surface (114, p. 161); Ditmars (37, p. 312); Forbush (45, p. 41); Netting (88, p. 26). Canary, Touissant (116, p. 222). Barn swallows, canary, Forbush (45, pp. 42-43).

Chicken snake, *Elaphe obsoleta confinis*, birds, young chickens and eggs, Hurter (63, p. 181). Birds, Corrington (31, p. 73).

Lindheimer's coluber, *Elaphe obsoleta lindheimeri*, hens' eggs, Ditmars (37, p. 306). Contents of birds' nests, Garman (50, p. 291).

Banded chicken snake, *Elaphe quadrivittata*, chickens, hens' eggs, Ditmars (37, pp. 311-312). "Habit of stealing chickens from roost", Wood (122, Vol. 3, p. 131).

Fox snake, *Elaphe vulpinus*, sparrows, birds and their eggs, Ditmars (37, p. 298); Surface (114, p. 162). Eggs of common tern, Lyon (75, p. 186); Williams (75, p. 186).

All culubers, birds and eggs, Ditmars (37, p. 294); Boulenger, G. A. (22, p. 330).

Indigo snake, blue gopher snake, *Drymarchon corais couperi*, Ditmars (37, p. 278).

Big cribo, *Drymarchon corais melanurus*, birds, Ditmars (37, p. 278).

Pine snake, *Pituophis melanoleucus*, birds, Surface (114, p. 171). Birds and eggs, hens' eggs, Ditmars (37, p. 318).

Bull snake, *Pituophis sayi*, birds and eggs, Hurter (63, p. 174). Birds and hens' eggs, Ditmars (37, p. 319). Birds, sparrows, pigeon's egg, Ruthven (97, p. 583); Branson (23, p. 360). Chewink and eggs, Nauman (86, p. 330). Young chewinks, Over and Thoms (92, p. 26). In wren's nest, Seiler (103). English sparrows, Force (46). Young blackbirds, Keller (69, p.). Eggs of Townsend's solitaire, Hunter (62). Glass nest egg, Trine (117, p. 4).

Speckled king snake, *Lampropeltis getulus holbrooki*, small birds, Hurter (63, p. 185); Force (46, p. 32).

Common king or chain snake, *Lampropeltis getulus getulus*, sparrows, Ditmars (36, p. 270, and 37, p. 362). Birds, a chipping sparrow, Blanchard (19, p. 52). Birds, Wood (122, Vol. 3, p. 131).

Boyle's king snake, *Lampropeltis getulus boylii*, contents of quails' nests, Blanchard (19, p. 78); Van Denburgh (70, p. 172).

Brown king snake, mole snake, *Lampropeltis rhombomaculata*, young birds, Ditmars (37, p. 355); Blanchard (19, p. 131).

Yellow-bellied king snake, *Lampropeltis calligaster*, young birds, Ditmars (37, p. 356).

Milk snake, house adder, *Lampropeltis triangulum triangulum*, bird, robin's egg, Surface (114, pp. 178-179). Birds, cowbirds' eggs, Blanchard (18, p. 48); Forbush (45, p. 44); Netting (88, p. 26). Eggs of red-winged blackbird, Nauman (86).

Grass snake (European) birds, Palmer and Westell (93, p. 228).

Water snake, *Natrix sipedon*, eggs and young of marsh wrens and rails, Forbush (45, p. 46).

Plains garter snake, *Thamnophis radix*, dead birds, Ruthven (97, p. 13).

Common garter snake, *Thamnophis sirtalis*, sparrow, Surface (114, p. 149).

Garter snake, *Thamnophis elegans*, dead birds, Ruthven (97, p. 13).

Garter snakes, *Thamnophis*, birds, New Internat. Encyc. (89); Fledgeling birds, Ruthven (97, p. 13). Bobolink eggs, Gabrielson (48). Young yellow warbler, Bigglestone (16). Eggs and young of birds, Forbush (45, p. 45).

Rubber boa, *Charina bottae*, very small birds, Ditmars (37, p. 212).

Anaconda, *Eunectes murinus*, waterfowl, Netting (88, p. 26).

Boa constrictor, birds, Schmeil (102, p. 241).

Boas, family *Boidae*, feathered creatures, Ditmars (36, p. 220); Netting (88, p. 26).

Rock python, *Python reticulatus*, "two 8-pound roosters every ten or twelve days". Netting (88, p. 27).

Pythons, birds, Stebbing (107, p. 183); Boulenger, G. A. (22, p. 245); Netting (88, p. 26).

Snakes, robbed two nests of prothonotary warbler in Louisiana, Ganier (49). Enemies of Bob-whites, Howell (60, p. 89); Catbird eggs, Over and Thoms (92, p. 26).

References

1. Abbott, C. C. Naturalist's rambles about home. Appleton, 1885.
2. Allen, A. A. Auk, 41, 1924, pp. 1-16.
3. Atkinson, D. A. and Netting, H. Graham. The distribution and habits of the massasauga. Bull. Antiven. Inst., July, 1927.
4. Audubon, John James. Birds of North America.
5. Bailey, Florence Merriam. Handbook of the birds of Western United States. Boston, Houghton, 4th Ed., 1914.
6. Bailey, Mrs. Mary L. The Wilson Bulletin, Dec., 1925, p. 221.
7. Baker, Frank C. Proc. Acad. Nat. Sci., Philadelphia, 41, 1889.
8. Baldwin, S. Prentiss. The Wilson Bulletin, 36, 1924, p. 103.
9. Barbour, Thomas. Reptiles and Amphibians.
10. Barrows, W. B. and Schwartz, E. A. The Common Crow of the United States. Bull. 6, U. S. D. A. Div. Orn. and Mam., 1895.
11. Barrows, W. B. Michigan Bird Life. Special Bulletin, Mich Agr. College, 1912.
12. Baskett, James Newton. The Story of the Birds. Appleton New York, 1902.
13. Baynard, Oscar E. The Wilson Bulletin, 24, 1912, pp. 167-169.
14. Baynard, Oscar E. The Wilson Bulletin, 25, 1913, pp. 103-117.
15. Beal, F. E. L. U. S. Biol. Surv. Bull. 34, 1910.
16. Bigglestone, Harry C. The Wilson Bulletin, 25, June, 1913.
17. Blanchan, Neltje. (Mrs. Doubleday). Bird Neighbors.
18. Blanchard, Frank N. Amphibians and Reptiles of the Douglas Lake Region in Northern Michigan. Copeia, 1928.
19. Blanchard, Frank N. A revision of the king snakes, Genus *Lampropeltis*, Smithsonian Inst., U. S. N. Museum Bull. 114, 1921.
20. Blatchley, W. S. Notes on the Batrachians and Reptiles of Vigo County, Ind. 24th Ann. Rept. State Geologist, 1899.
21. Boulenger, E. G. Animal Mysteries. Macaulay.

22. Boulenger, Geo. A. Fauna of British India, Reptilia and Batrachia. London, 1890.
23. Branson, Edwin B. Snakes of Kansas. Kansas Univ. Science Bull., Vol. 2, No. 13, 1904.
24. Burroughs, John. Wake-Robin.
25. Cahn, Alvin R. Auk, 32, 1915, pp. 94-95.
26. Cameron, E. S. Swainson's hawk in Montana. The Auk, 30, 1913.
27. Chapman, Frank M. Bird-Life. Appleton, 1903.
28. Cockerell, T. D. A. N. Mex. Agr. Exp. Sta. Bull. 37, 1901.
29. Cope, E. D. Crocodilians, lizards, and snakes. Ann. Rpt. Smithsonian Inst., 1898.
30. Cope, E. D. A critical review of the characters and variations of the snakes of North America.
31. Corrington, Julian D. Copeia, No. 172, 1929.
32. Crimmins, Col. M. L. Rattlesnakes and their enemies in the southwest. Bul. Antiv. Inst. of America, Vol. V, No. 2, 1931.
33. Daglish, Eric Fitch. The life story of birds. Morrow, New York.
34. Davie, Oliver. Nests and eggs of North American birds. 4th Edition, 1889.
35. DeKay, James E. Zoology of New York, Part III.
36. Ditmars, Raymond L. Reptiles of the world.
37. Ditmars, Raymond L. The reptile book. Doubleday Page, 1922.
38. Dugmore, A. Radclyffe. Bird homes. Doubleday & McClure, 1900.
39. Eaton, Elon Howard. Birds of New York. N. Y. State Museum. Mem. 12, 1914.
40. Eliot, Willard Ayres. Birds of the Pacific Coast. Putnam, 1923.
41. Finn, Frank. Bird behavior. New York, Dodd.
42. Fisher, A. K. Div. Orn. and Mamm. Bull. 3, 1893.
43. Fitzsimons, F. W. The natural history of South Africa. Birds. Vols. I and II.
44. Forbush, Edward Howe. Useful birds and their protection. 1907, p. 371.
45. Forbush, Edward Howe. The natural enemies of birds. Econ. Biol. Bull. No. 3, Mass. State Board Agric., pp. 40-46.
46. Force, Edith R. The amphibians and reptiles of Tulsa County, Oklahoma and vicinity. Copeia, 1930, No. 2.
47. Friedmann, Herbert. The Cowbirds. Springfield, 1929, pp. 259-260.
48. Gabrielson, Ira N. Bird Lore, 24, p. 137.
49. Ganier, Albert F. Bird Lore, 2, 1900, p. 89.

50. Garman, H. A synopsis of the reptiles and amphibians of Illinois. Bull. Ill. State Lab. of Natural History, Vol. 3, 1892.
51. Gignoux, Claude. Shrike attacking snake. Condor, XXIX, 1927. p. 75.
52. Gilmore, Esther E. Manuscript.
53. Gloyd, Howard Kay. The Wilson Bulletin, Sept., 1925, p. 141.
54. Greenwich Bird Protective Society, 1st Ann. Rpt. Greenwich, Conn., 1915.
55. Guthrie, J. E. The snakes of Iowa. Agr. Exp. Sta. Iowa State College, Bull. 239.
56. Hay, O. P. The Batrachians and Reptiles of the State of Indiana.
57. Henderson, Junius. Practical value of birds, 1927, p. 227.
58. Holt, Ernest G. Copeia, Dec., 1929.
59. Howell, Arthur H. Birds of Arkansas. U. S. D. A. Biol. Surv. Bull. 38, 1911.
60. Howell, Arthur H. Some game, birds, and fish of Alabama. Dept of Game and Fisheries of Alabama. 1925.
61. Hume. Nests and eggs of Indian birds. 2nd Ed. V. 1.
62. Hunter, J. S. Osprey, IV, 1900, p. 173.
63. Hurter, Julius, Sr. The Herpetology of Missouri. Trans. Acad. Sci. St. Louis, XX, 1911.
64. Ingersoll, Ernest. The wit of the wild. 1906.
65. Ingersoll, Ernest. Birds of Legend, Fable and Folklore. Longmans, 1923.
66. Jaeger, Edmund C. Denizens of the desert. Houghton, 1922.
67. Judd, Sylvester D. U. S. Biol. Surv. Bull. 17, 1902.
68. Judd, Sylvester D. U. S. Biol. Surv. Bull. 9, 1898.
69. Keller, Mrs. F. J. N. O. U. Letter of Information, No. 44, p. 8.
70. Klauber, L. M. Some observations on the rattlesnakes of the extreme southwest. Bull. Antiven. Inst. of America, Vol. 1, No. 1. March, 1927.
71. Law, J. Eugene. Condor, 25, 1923, p. 179.
72. Linsdale, Jean M. Univ. Kansas Sci. Bull., XVIII, No. 11, Apr., 1928, p. 557.
73. Loveridge, A. Notes on snakes and snake-bites in East Africa. Bull. Antiven. Inst. of America, April, 1928.
74. Lucas, A. H. S., and LeSouef, W. H. D. The Animals of Australia. 1909.
75. Lyon, W. I. The Wilson Bulletin, 39, Sept., 1927, p. 186.
76. McIntosh, Franklin Gray. Bird Lore, 24, 1922, p. 152.

77. McAtee, W. L. Food habits of the mallard ducks of the United States. U. S. D. A. Bull. 720, 1918.
78. McAtee, W. L. Nature Magazine. Feb., 1930, p. 113.
79. McLean, Donald D. The owls of California. Teachers' Bulletin, Calif. Fish and Game Commission, No. 10, 1928.
80. Marshall, W. A. Bird Lore, 1921, p. 304.
81. Merrill, James C. Notes on the ornithology of southern Texas. Proc. U. S. National Museum, 1878.
82. Mitchell, S. Weir. Researches on the venom of the rattlesnake. Smithsonian Rept., 1860.
83. Morris, Robert T. Bird Lore, 27. 1925. pp. 253-254.
84. Morse, Max. Batrachians and reptiles of Ohio. Ohio State Univ. Bull. Series 8, No. 18, 1904.
85. Myers, Harriet Williams. Western Birds. 2nd Ed. Rev. Macmillan, 1923.
86. Nauman, E. D. Bird Lore, XXXI, 1929, pp. 330-331.
87. Neff, Johnson A. Oologist, 29, 1924, pp. 117-118.
88. Netting, M. Graham. Cardinal, Vol. II, No. 2, July, 1927, pp. 25-29.
89. New International Encyclopedia. 2nd Ed.
90. Nicholson, Donald J. The Wilson Bulletin, 41, 1929; 42, 1930.
91. Over, William H. Amphibians and reptiles of South Dakota. S. Dak. Geol. Nat. Hist. Surv., Bull. 12, 1893.
92. Over, William H. and Thoms, Craig S. Birds of South Dakota. S. Dak. Geol. Nat. Hist. Surv. Series XXI, No. 9, 1921.
93. Palmer, Ray, and Westell, W. Percival. Pests of garden, orchard, farm, and forest. Drane, London, 1922.
94. Pearson, T. Gilbert. Birds of North Carolina by Brimley, C. S. and Brimley, H. H.
95. Pycraft, W. P. A history of birds. Methuen & Co., London, 1910.
96. Roddy, J. Hustin. Feeding habits of some young Raptores. The Auk. V, 1888.
97. Ruthven, Alevander G. Variations and genetic relationships of the garter snakes. Smithsonian Inst., U. S. N. Museum, Bull. 61.
98. Ruthven, Alexander G. A collection of reptiles and amphibians from southern New Mexico and Arizona. Amer. Mus. Nat. Hist., Vol. 23, 1907.
99. Ruthven, Alexander G. The reptiles of Michigan. Mich. Geol. Biol. Surv. Publ. No. 10, 1912.
100. Saintleven, August. A Texas Pioneer. (Quoted by Crimmins (32).

101. Schaeffer, J. Parsons. Bird Lore, 8, 1906, pp. 137-8.
102. Schmeil, Otto. Introduction to Zoology. A. and C. Black, London, 1901.
103. Seiler, Lydia Joanna. Bird Lore, 29, 1927, p. 189.
104. Simpson, R. B. Oologist, 29, 1912, p. 402.
105. Smith, Francis Gow. The snake, Brazil's national problem. World's Work, 1926.
106. Spencer, Hugh. Bird Lore, 30, 1928, pp. 108-110.
107. Stebbing, Edward Percy. A Manual of Forest Zoology for India. Government Printing, Calcutta, 1908.
108. Stejneger, Leonhard. The poisonous snakes of North America. Rept. U. S. Nat. Mus. for 1893.
109. Stejneger, Leonhard. The reptiles of the Huachuca Mts., Arizona. Proc. U. S. Nat. Mus., XXV, 1902.
110. Stoddard, Herbert L. Progress on Cooperative Quail Investigations, 1924.
111. Strecker, John K. On the use, by birds, of snakes' sloughs as nesting material. The Auk, 1926, pp. 501-507.
112. Storer, D. Humphreys. Reptiles of Massachusetts. Zoological and Botanical Survey, Mass., 1839.
113. Stull, Olive Griffith. A revision of the genus Tropidophis. Occasional Papers, Univ. of Mich., No. 195, Oct. 1, 1928.
114. Surface, H. A. The serpents of Pennsylvania. Penn. State Dept. of Agr. Monthly Bulletin, IV, 4 and 5, 1906.
115. Thorburn, Archibald. British Birds, Vol. II.
116. Touissant, Mrs. L. H. The Bluebird, Vol. VII, No. 8, May, 1915.
117. Trine, Mrs. George. N. O. U. Letter of Information, No. 50, p. 4.
118. Van Denburgh, John. The reptiles of the Pacific Coast and Great Basin. Occ. Papers, Calif. Acad. Sci., Vol. V, p. 172.
119. Whitaker. Birds of Tunisia. London, 1905, Vol. 1.
120. Wilson, Alexander, and Bonaparte, Charles Lucian. American Ornithology.
121. Wilson, Ralph R. Bird Lore, XXV, 1923, p. 124.
122. Wood, J. G. Illustrated Natural History. Routledge, 1869, Vols. 2 and 3.

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EDITORIAL

The Nineteenth Annual Meeting of the Wilson Ornithological Club will be held at Columbus, Ohio, on the three days following Thanksgiving Day, November 25, 26, 27, 1932. The sessions will be held on the campus of the Ohio State University, in the auditorium of the Ohio State Museum. The program will occupy Friday and Saturday. For Sunday a field trip is planned, with Buckeye Lake as the destination. The Christmas census last year yielded seventy-four species within a half-mile of the shore of this lake. The Wheaton Bird Club, of Columbus, will act as host. The Henninger collection of birds and the Bale collection of eggs will be features of interest. With the large Club membership in Ohio and adjacent states, this meeting may be expected to have a splendid program and a large attendance.

As Is Known to most of our readers President Shaver has been making a strong effort to increase our income this year so that there may be a minimum reduction in the size of our magazine. The response so far has been very encouraging, though everyone realizes, of course, that the problem is a serious one. Two of our members, Mrs. Carll Penwood Tucker and Mr. E. A. McIlhenny, have become life members. Others have contributed by changing their membership classification to a higher rank, and several have made cash contributions. A few authors are proposing to make contributions towards the cost of publishing papers. All of these aids are gratefully appreciated by the officers, and will help to carry us through. The officers are determined to avoid any deficit.

GENERAL NOTES

Conducted by M. H. Swenk

An Early Arrival of the Bobolink in Indiana.—On March 13, 1932, during a hurried trip to Ohio, as dusk approached and we were driving rapidly, we saw a lone Bobolink (*Dolichonyx oryzivorus*) fly up and across the road into a field. I could not understand how that bird could be in this part of the country at that early date, for I never previously had seen it before May 4, with one exception. It generally is found, according to my past records for ten years, between May 4 and June 13, although these dates may not be those of first arrival. One year (1924), the Bobolink was seen April 6. That was my earliest record before this year. But we have had unusual winters the past two years, hardly knowing winter had been with us. I believe the Bobolink had come upon the heels of the mild winter, before it knew it was not yet time for migration. As a rule these birds come in flocks, as I have seen fifty or more males together before they separate, making it evident, as with some other migrants, that the males come first together. The Robins do this, the males appearing about two or three weeks before the females. Many different varieties arrive together, then separate. I have seen the Bronzed Grackles, Starlings, and others all feeding on the ground together in the early spring. Warblers and other small migrants do the same. Birds of many varieties collect together in the fall before returning to the south, but when they are nesting they will have nothing to do with the other birds of various species.—Mrs. Horace P. Cook. *Anderson, Ind.*

Further Comment on the Nesting of the Blue-gray Gnatcatcher.—I have read with much interest the note of Mrs. Horace P. Cook, of Anderson, Indiana, (Wilson Bulletin, XLIV, p. 45), on the nesting of the Blue-gray Gnatcatcher (*Polioptila caerulea caerulea*). In more than forty years of observation I have never seen a nest of this species in a location other than on top of a horizontal limb. I have found them placed as Mrs. Cook describes, on top of the lower fork of a limb that branched vertically, so that the upper fork furnished some protection to the nest. Also, I have frequently noticed that the nests of both gnatcatchers and Ruby-throated Hummingbirds usually disappear in whole or in part soon after the young leave them, and the following incident suggests a reason.

I had located a Blue-gray Gnatcatcher's nest about thirty feet up in a slender oak, and a few days after the young had left it I went to the place to collect it. After shinning about two-thirds of the way up to the nest, I paused on a limb to catch my breath. In less than a minute a gnatcatcher came to the nest, and with much twittering began to pull material out of it. She soon had a bill full and flew away to the south. Thoroughly interested, I waited, and in a few minutes she returned and carried away another bill full of material.

I came down and followed her line of flight directly to where she was building a new nest. I had no means of knowing whether or not it was the same bird building a second nest from the materials of a first nest.—John B. Lewis. *Amelia, Va.*

Ground-Nesting Birds.—Two very unusual records of ground-nesting birds have come under my observation, one of the Eastern Mourning Dove (*Zenaidura macroura carolinensis*) and the other of the Brown Thrasher (*Toxostoma rufum*). In June, 1929, in crossing a field, I found where an Eastern Mourning Dove had

placed a few sticks to form a frail nest, which contained two white eggs, under a small overhanging tree, in the niche of the bank of a tiny stream. At New Vienna, in 1900, I found a Brown Thrasher's nest on the ground protected by a pile of osage-orange brush. In this section all of the early nestings of the Eastern Song Sparrow (*Melospiza m. melodia*) and of the Red-eyed Towhee (*Pipilo e. erythropthalmus*) are placed on the ground. The second nests of the season of the Eastern Song Sparrow are placed from two to ten feet up, in weeds, shrubs, and small trees. The Red-eyed Towhee most generally builds a couple of feet high in a shrub for its second nesting. An exception to this was the placing of a nest on a corn stalk where the leaf-blade joined the stalk, about three feet from the ground.—Katie M. Roads, *Hillsboro, Ohio.*

A Flight of Franklin's Gulls in Northwestern Iowa.—On September 17, 1931, I noticed about one hundred Franklin's Gulls (*Larus pipixcan*) resting in a compact group on Medium Lake, just north of Emmetsburg, Palo Alto County, Iowa. This was at 9 A. M. They arose and seemed to leave the lake soon after. The rest of the day I spent looking over game range in Palo Alto, northwestern Kossuth, and eastern Emmet Counties. Over almost all this territory there was a continuous body of gulls, evidently feeding on some flying insect.

Until evening the birds were flying at heights of fifty to one hundred yards. Toward evening they gradually grew lower, until at 5 P. M. they were on or near the ground level. At the same time my car began to pass through insects. Evidently the insects themselves had changed the level of their flight. Samples were collected and submitted to Carl Drake, State Entomologist, for identification. Unfortunately the specimens were mashed in the mails, so that the species could not be determined. Dr. Drake wrote me they were flea-beetles of some kind. This flea-beetle was evidently the attraction for the gulls.

The flight of gulls was observed over an area covering a total of four townships in Palo Alto, five in Kossuth, and four in Emmet Counties, a total of thirteen townships. It may have been actually much larger. On the other hand, the gulls may have accidentally followed our route of travel, and thus not actually covered thirteen townships. The density is estimated to have ranged from one to two hundred gulls to forty acres. Assuming that it covered ten townships and that the density averaged two gulls to forty acres, the total number of gulls would have been about thirty to the section, 1,100 to the township, or 11,000 gulls on the observed area. The density probably averaged much more than two gulls to forty acres.

Frank Marnette of Arnold's Park, Kossuth County, Iowa, a competent observer, tells me that these inland flights of Franklin's Gulls are a regular autumnal phenomenon, but that in his county every individual returns each evening to Spirit Lake to roost.—Aldo Leopold, *Madison, Wis.*

The Philadelphia Vireo Near Nashville, Tennessee.—On September 18, 1931, I was studying migrant warblers and vireos near my camp, Birds-I-View, some ten miles east of Nashville, Tennessee, when my attention was directed to the song of a bird about twenty feet away in an elm tree. Its notes were rather like those of a Red-eyed Vireo but more melodious, less continuous, and at times suggestive of the notes of the Purple Finch. Since vireos had practically ceased to sing I watched this bird very carefully as he moved sluggishly around just above my head. To my surprise there was a pale yellow color to the entire breast; and there were no wing bars as in the case of the White-eyed Vireo and

the Yellow-throated Vireo. Nor was it large enough for the Mountain Vireo. On consulting Chapman, I found that its markings, song, and habits corresponded exactly to those of the Philadelphia Vireo (*Vireo philadelphicus*).

On September 19 it was near the same tree but did not sing. Mr. A. F. Ganier attempted to collect a similar bird at this spot on September 20, but it was lost in the rank weeds. Nearly a week later I tried to take a specimen of this bird some five hundred yards farther south but was unsuccessful. The first bird, I am satisfied, was the Philadelphia Vireo; but in the other three instances there was no song to confirm the markings. My feeling now is that this species is more often to be found than records show and next spring all suspicious vireos will be given careful scrutiny. Perhaps we can add other records to the lone record of Allison at Grand Junction, in west Tennessee, April 16, 1904.—George R. Mayfield, *Nashville, Tenn.*

The 1931 Fall Migration at Cleveland's Public Square.—This year's fall migration at the Public Square in Cleveland was not as productive in my observation as the past two years.

In the period from September 11 to December 28 I was successful in finding sixteen species of native birds. During this stretch of 108 days I visited the Square 83 days and found one or more birds on all but two days. The weather was uniformly favorable, with the temperature consistently above freezing, except for a brief cold snap with snow in the closing days of November. The temperature was frequently far above normal, reaching 63° on December 24, and nearly to that mark on several occasions. My records are as follows:

Species	*First Record*	*Last Record*	*No. of Days Seen*	*Largest No. in One Day*
Sparow Hawk	Sept. 11	Oct. 28	4	1
Herring Gull	Oct. 29	Dec. 15	2	7
Whip-poor-will	Oct. 9	.....	1	1
Yellow-bellied Sapsucker	Sept. 28	.....	1	1
Golden-crowned Kinglet	Oct. 9	.....	1	1
Ruby-crowned Kinglet	Sept. 28	Sept. 30	2	1
Magnolia Warbler	Sept. 16	.....	1	1
Black-poll Warbler	Sept. 12	Sept. 17	3	2
Northern Yellowthroat	Sept. 16	Sept. 21	4	4
Redstart	Sept. 12	.....	1	1
Savannah Sparrow	Sept. 16	Sept. 17	2	2
White-crowned Sparrow	Oct. 7	Nov. 17	13	4
White-throated Sparrow	Sept. 16	Dec. 28	75	14
Trec Sparrow	Nov. 11	Nov. 24	8	1
Song Sparrow	Sept. 21	Dec. 11	37	3
Rose-breasted Grosbeak	Sept. 16	.....	1	3

Most of these visitors are becoming familiar to me at the Square, but several of them were newcomers, notably the Whip-poor-will, Yellow-bellied Sapsucker, and Magnolia Warbler. The Whip-poor-will spent the day on the ledge of my office window, a windy day with the temperature around 55°. The bird showed no sign of injury, but seemed very weak. It exhibited no great fear of faces not more than a foot away on the other side of the window, rocking nervously when some one tapped on the glass. October 9 is some three weeks later than the usual time of departure for this species, and several cool days probably had made serious inroads on the bird's food supply. Three Rose-breasted Grosbeaks appeared together in the plane trees surrounding Tom Johnson's statue one day, all in the streaked plumage of the female or immature. White-throated Sparrows

occurred in smaller numbers than in past years but persisted later than previously. The Yellow-bellied Sapsucker worked on the trunk of a plane tree on a level with my eyes, not more than five feet away.

It is interesting to note that the Starlings were more numerous than ever and have stayed through the winter, coming in from the edge of the city every evening to roost on the cornices and string courses of buildings around the Square. Some observers have estimated that there are at least 15,000 Starlings roosting within a block of the Square, yet it is seldom that one is seen during the day.—William H. Watterson, *Cleveland, Ohio.*

The Former Occurrence of the Mississippi Kite in Ohio.—In a considerable quantity of bones of birds from archeological excavations in Jackson County, Ohio, submitted to the National Museum for identification by the Ohio State Museum, I found two humeri of the Mississippi Kite (*Ictinia misisippiensis*), a species that has not been reported from Ohio previously, so far as I am aware. The bones in question were secured in Canter's caves, located about five miles northwest of the town of Jackson, in Jackson County, Ohio.[1] The caves in question are two rock shelters called Echo and Indian caves, respectively, located on the east side of Little Salt Creek, in a conglomerate many feet above the present stream level. The kite bones were associated with numerous other bird remains and quantities of human artifacts accompanied by several human skeletons.

Vol. 37, Jan., 1928, pp. 4-21, figs. 1-14.

The bird bones are in good condition and well preserved, all tendons and other tissues having disappeared. Their age is indefinite but probably dates back several hundred years. In the report cited in the accompanying footnote it is stated (p. 32) that "it seems indubitable that for the most part the occupants of the rock shelters of southern Ohio, in so far examined, were the Algonquian tribesmen of pre-Columbian and proto-historic times."

Nineteen species of birds were identified from the remains from Canter's Caves, including in addition to the Mississippi Kite bones of the Mallard, Blue-winged Teal, Ring-necked Duck, Lesser Scaup Duck, Wood Duck, Swallow-tailed Kite, Duck Hawk, Ruffed Grouse, Prairie Chicken, Bobwhite, Turkey, Passenger Pigeon, Barred Owl, Pileated Woodpecker, Flicker, Raven, Crow, and Grackle (*Quiscalus*).

One humerus of the Mississippi Kite has been presented to the U. S. National Museum, the other being retained by the Ohio State Museum.—Alexander Wetmore, *U. S. National Museum, Washington, D. C.*

A Large Flock of Bank Swallows Near Toledo, Ohio.—Most of my readers are familiar with the great gatherings of swallows in late summer. Sometimes these conventions are of Bank Swallows, sometimes of Tree Swallows, or, too rarely in these days, of Barn Swallows.

Because of their proximity to the lake marshes, Toledo and its suburbs extending to the east play host to varying numbers of swallows each year. Up to 1931 the greatest flock I had ever witnessed was a flight of about 10,000 Bank Swallows (*Riparia riparia*) seen on July 15, 1928. This year, probably as the result of the drying up of all inland ponds, Bank Swallows were unusually common. The greatest number appeared on August 8, 1931, when the Little Cedar Point marsh, about ten miles or so east of Toledo, was visited by a huge flock of Bank Swallows, the number of which I estimated to be more than 250,000.

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[1]For an account of these sites see Shetrone, H. C., Ohio Arch. Hist. Quart.,

Even as I write this I seem to see thousands of eyebrows lifted in doubt, and I seem to hear scornful sniffs from every side. Two hundred and fifty thousand! Who counted them? Here was the situation: Along the west side of the Little Cedar Point property, betwcen the marsh and Maumee Bay, a stone road bordered by large trees leads up to the clubhouse. Millions of gnats which had bred in the swamp rested on these trees during the day and swarmed forth in great clouds at dusk. These myriads of insects attracted Bank Swallows to such an extent that they formed a group about one mile long, measured by the speedometer, and 1,000 feet in width. The density of most of this constantly moving mass was almost unbelieveable. The scene resembled nothing more than a highly magnified section of the swarms of gnats upon which the birds fed. Mingled with the Bank Swallows were a few hundred Tree Swallows and Barn Swallows, Starlings, and a flock of Common and Black Terns.

The mathematics of the case is quite simple: Allowing each swallow twenty square feet, without making any allowance for the additional number resulting from figuring the third dimension also involved, 5,000 times 1,000 equals 5,000,000 gives the very conservative estimate of 250,000. Actually there may have been nearly a million.

This congregation marked the climax of the flight, although large flocks were seen both before and after that date, roosting on telephone wires along the roadside. This habit of roosting makes estimating numbers a very easy task for the observer. The count for the entire season is: July 12—100; July 18—200; July 26—3,000; August 2—8,000; August 8—250,000; August 15—30,000; August 23—50,000; August 30—500; September 7—50; and September 13—8.—Louis W. Campbell, *Toledo, Ohio.*

ORNITHOLOGICAL LITERATURE

Florida Bird Life. By Arthur H. Howell. Published by the Florida Department of Game and Fresh Water Fish, in coöperation with the Bureau of Biological Survey, United States Department of Agriculture. 1932. Pp. i-xxiv+1-579. Pls. 1-58 (37 in color). Figs. 1-72 (mostly maps). Price, $6.00 (to be ordered from the Department of Game and Fresh Water Fish, Tallahassee, Fla.).

The new year in ornithological literature opened with the distribution in January of Howell's "Florida Bird Life". This is another large, single volume, somewhat comparable with Bailey's "Birds of New Mexico", and also prepared through the coöperation of the United States Biological Survey. To make the comparison go further, this volume is also published through the generosity of a patron, Marcia Brady Tucker, of New York. The latter fact should be emphasized in order to express our gratitude and also as an example to others who may be philanthropically inclined toward science.

The text of this new work opens with a very full historical account of Florida ornithology. It seems to us that this is one of the most important parts of a work of this kind. There is also a section listing all of the birds which have been described from specimens taken in Florida, of which there are 82—a considerable number. The history of bird protection in the state makes a separate chapter written by Mr. Robert W. Williams. A chapter each on physiographic regions and life zones then brings us to the catalogue proper. The latter treats

423 forms, including 362 species and 61 additional subspecies. The routine account of each species includes statements on recognition marks, range, Florida distribution, haunts and habits, and food. Supplementing the text there are many state maps (about 71 of them) marked to show the distribution of a given species within the state. This we regard as the most valuable single feature of the book, even though the information may be incomplete in some cases.

Besides the text figures (maps) already mentioned, the chapter on life zones contains an inserted colored map of the state showing the distribution of life zones. Of the fifty-eight plates twenty-one are in black, and are reproduced from photographs by various artists. The remaining plates are in color and are reproduced from paintings by Francis L. Jaques. It has been the avowed intention of the artist to group his subjects together according to their habitat, rather than according to their relationships. This seems to be an innovation in the composition of modern bird pictures. We are not sure that we like it quite as well. Perhaps it leads the artist to give too much emphasis to the landscape, resulting in a corresponding reduction in the bird portraits. Most of the water bird plates are composed in this style, while the shore birds and land birds have been shown in the conventional way. Our preference would be for the shore bird plates. Possibly this is because we feel that the artist has been more successful in portraying the resting bird than the one in flight.

Mr. Howell is so well known through his connection for thirty-five years with the United States Biological Survey and his authorship of the "Birds of Arkansas" and the "Birds of Alabama", that the authenticity of the text may be accepted at face value. One by one the states are putting out their ornithologieal treatises in a sumptuous style hitherto almost unthought of; and made possible, doubtless, by the very great and widespread interest in the study of bird life. With these beautiful descriptive works now available, we are forced to reflect on the calamity which will befall the human world in each instance of extermination of these interesting creatures. It seems certain that each succeeding human generation will regard its bird life with inereasing curiosity and concern. The present generation indeed owes much to the future in this matter.

A bibliography covering seventy-nine pages is probably quite complete, and is correspondingly valuable. A list of biographical references to students of Florida birds is a novel feature.—T. C. S.

Handbook of Birds of Eastern North America with Introductory Chapters on the Study of Birds in Nature. By Frank M. Chapman. Second revised edition. Published by D. Appleton and Company, New York, 1932. Pp. i-xxxvi+1-581. Pls. I-XXIX, figs. 1-166. Price, $5.00.

This book, the second contribution of the year to American ornithological literature, is the same "Handbook" as of other years, but modified to conform to the new A. O. U. Check-List in nomenclature and sequence. The Handbook has been in use so long and is so well known, that it is sufficient merely to announce the revised edition. Except for the new names and the altered sequence we see very little change from the last edition. The new edition contains, nevertheless, fifty-one pages more than the former one. There is the same preliminary study of "the bird", making an excellent practical introduction to ornithological knowledge, the value of whieh is enhanced by generous reference to other literature.

The bibliographical appendix is a most valuable portion of the book, and has been brought up to date in this last edition.

The older editions of this book are still good for identifications, but for technical names and sequence they will lead the student astray in many cases. It may be truthfully said that Chapman's Handbook is the lineal successor to Coues' Key; perhaps not so indispensable to the student as was the Key, because of the abundance of good bird literature now available in these modern days. Yet, every earnest student of birds requires a descriptive manual with keys dealing with all the birds of the larger territory in which his interest lies. The Handbook now meets this need in an admirable way. An interval of thirty-one years elapsed between the first and the last (5th) edition of Coues' Key. Now thirty-seven years have already passed between the first and the present edition of Chapman's Handbook, and it seems to be destined for many more years of usefulness.—T. C. S.

Effectiveness in Nature of the So-called Protective Adaptations in the Animal Kingdom, Chiefely as Illustrated by the Food Habits of Nearctic Birds. By W. L. McAtee. Smithson. Misc. Coll., Vol. 85, No. 7, pp. 1-201. Washington, D. C., 1932.

In the days before Darwin developed the theory of natural selection, color in animals was generally looked upon as accidental and non-significant. As the selection principal became better understood color patterns were interpreted as adaptive, i. e., protective. Some color patterns were explained as concealing in effect, so that natural enemies were prevented from finding and devouring the possessor. Other color patterns were regarded as revealing in effect, but were supposed to confuse or frighten away the predator. In all these cases of protective color adaptation the result was to preserve or "select" the possessor and allow him to reproduce. There is a discrimination in nature, therefore, in favor of those animals which possess some color or other protective adaptation. This is the principle of natural selection, briefly stated. Through this principle of selection the color pattern, often a specific characteristic, was believed to have originated and to have become perfected. Thus it became a method of evolution.

Mr. McAtee questions whether nearctic birds actually practice any discrimination in the capture of food animals because of the latter's possession of color pattern or other so-called protective adaptation. If these protective adaptations are serviceable to the owners there should be what might be called a differential death rate among them. And if there is such a difference in the death rate among the food animals of birds it should be discoverable in the stomach contents of birds. The author undertakes to show that most animals are used as food by nearctic birds (and presumably the rule will apply in general) in proportion to their abundance, regardless of "protective adaptations". In order to show this he finds the estimated totals of animals in each phylum, and then the percentage of species in each phylum to the whole number of species. For instance, there are estimated to be 418,250 species of arthropods, which is 74.6188 per cent of all known species of animals. Then it is found that from 80,000 bird stomachs examined in the U. S. Biological Survey since 1885, 237,399 species of animals have been identified. For instance, 210,752 species of arthropods were identified, which amounts to 88 7751 per cent of the whole number identified. The approximation of these two percentages is interpreted as indicating that the food

is taken at random and in proportion to abundance—not by selection of unprotected forms.

The several phyla are then examined by the same method, and a very strong case is made against color and other supposed protective adaptations, and for the theory of indiscriminate capture. The author says, "Within size limits, animals of practically every kind accessible to birds are preyed upon, and as we consider the records for group after group a tendency for the number of captures to be in proportion to the abundance of the animals concerned is unmistakable. Availability undoubtedly is the chief factor involved in the choice of food, and predation therefore tends to be in proportion to the population."

Our experience, derived from field observation without statistical measurement, leads us to acquiesce in the view that "predation tends to be in proportion to population". But a count of species is one thing and a population of individuals is something quite different. Birds are prone to feed heavily upon a species when it is at a numerical maximum or in a state or irruption. This excess of one insect species upon which birds may easily satisfy their appetities doubtless protects another species more than any color pattern which the latter may possess. We predict, however, that selectionists will not docilely yield ground which they have held, almost without dispute, for a generation. Mr. McAtee is boldly attacking a fundamental and far-reaching problem.—T. C. S.

What Bird Is That? A Guide to the Birds of Australia. By Neville W. Cayley. Published by Angus & Robertson, Ltd., 89 Castlereagh St., Sydney, Australia. 1931. Pp. i-xx+1-319. Col. Pls. I-XXXVI, halftones, 14. Price, 12/6.

It is seldom that we are privileged to review a bird book from the other side of the ocean, and we are glad to present this particular one to our readers. The book is organized around the thirty-six colored plates. Each plate shows diminutive figures of a number of birds, varying from ten to thirty. A section, or chapter, of the text is then devoted to the description of these figures on the accompanying plate. The sequence of species is not systematic, but rather ecologic. That is, species are grouped on the plates (also in the text) according to their habitats. While this plan of arrangement varies from the usual custom, we can not see that the scientific value of the book is lessened in the least, while its usefulness is probably increased. In this way the book pictures in color and describes 708 species of native Australian birds. And many of the plates show the female in addition to the male.

The text does not describe the plumage, since the figures are amply descriptive for ordinary identification; the text does, however, treat of the distribution, nest, eggs, food, song, habitat, etc. Furthermore, the text is not burdened with subspecies; and thus we have an example of a perfectly scientific and usable treatise based upon the species concept alone. How conservative and sensible the Australians are in this matter!

The outstanding feature of the book is the colored plates, which are also the work of the author. The large number of portraits placed on each plate precludes the use of any background. Nothing is shown but the bird in perching or standing posture. And while the figure is necessarily small, it is clear and distinct, and is as adequate for identification as a larger one would be. Considering the

large number of species illustrated and the preciseness of the coloring, even in such small figures, we are bound to regard the book as a marked success.

The book is sponsored by the Gould League of Bird Lovers of New South Wales. We are astonished in reading that the League has a membership of six hundred thousand. In view of this fact, however, it is not surprising that the first edition of 3,500 copies was exhausted within the month of publication (December, 1931), and that a second edition was promptly issued. It may be worth mentioning that the publishers have also on their list a book on the snakes of Australia, and one on the Platypus, and we have no doubt that many college libraries in this country will have special need for the latter work, at least (at 10/6).—T. C. S.

The Birds of Louisiana. Bulletin No. 20, Louisiana State Department of Conservation. Pp. 1-598. Distributed by the Department of Conservation, 126 N. O. Court Building, New Orleans. Price, 25 cents. Free to residents of Louisiana.

The first thing to be noticed about this work is its anonymity. In general people prefer to read from a known author, to say nothing of the justice of giving credit to the author. On page 522 this remark is made: "If one were forced to have only one favorite among the many appealing and beautiful warblers, the Hooded Warbler would be mine." This is probably an unedited reminder of the unknown author's role. The introduction gives some credit to Mr. Stanley C. Arthur, but there is no way of knowing, from the text, to what extent Mr. Arthur is responsible for the preparation of the work. In the "History of the Pelican Seal" of Louisiana we think we recognize Mr. Arthur's workmanship. However, it is difficult to understand the desire to suppress the authorship of a work which would otherwise be a credit to the State. It is also unfortunate that the numerous illustrations are not credited to either an artist or to previous publications.

One is much puzzled at first with the key of families of perching birds (pp. 394-395) until it is discovered that the printer has paragraphed the family name with the description below rather than the one above, simply by a misplacement of spacing. In most cases the treatment of a species is accorded a heading, but in some cases this is omitted. Apparently, the slight is given to some birds because they do not nest in, or visit frequently, the area under consideration.

The text contains many interesting and descriptive comments on the habits of our common birds in the southland. Special attention is given to the various vernacular names, and in many instances the origin or meaning of both vernacular and scientific names is given, often to the enlightenment of the experienced reader. A curious mixture of ornithological and editorial Latin, found on page 384 (and several other places), gives the scientific name of the Pileated Woodpecker as *Phloeotomus pileatus stet*—trinomialism inadvertently carried too far! Perhaps after all the author will be happier with the omission of his name from a work over which he had lost editorial control. However, notwithstanding these criticisms we are compelled to admit that in no other instance have we seen so much information on birds given for so little money.—T. C. S.

The Physiology of Development of Feathers. I. Growth-Rate and Pattern in the Individual Feather. By Frank R. Lillie and Mary Juhn. Reprinted from Physiol. Zool., Vol. V, No. 1, Jan. 1932. Pp. 124-184, pls. I-VIII.

This paper is based on studies conducted under the auspices of the Whitman Laboratory of Experimental Zoology, at the University of Chicago. The text reports on two main lines of investigation, namely, the feather development and the experimental modification of feather type and pattern. The studies were made on the Brown Leghorn fowl, which has been the subject of study by the authors for eight years. While barnyard fowls do not make a strong appeal to nature lovers, yet they serve just as well for the study of biological problems, and the principles discovered may then be applied to wild birds in general. To facilitate their experimental work the authors found it necessary to go into the matter of regenerative development of the feather germ after plucking or normal molting. It may be sufficient to say that the mode of development of the feather is restated clearly, and with new facts and figures. The experimental work consisted of injecting the birds with thyroxin and female sex hormone. It was found that varying quantities of these hormones produced alteration in the color pattern of the growing feather—usually in the form of bars. The general trend of the work seems to be an analysis of the cause of color pattern in terms of physiological factors. Asymmetry in structure and color of feathers is briefly discussed. A more difficult experimental problem will be that of composite plumage color pattern.—T. C. S.

Birds of Polk County, Iowa. By Philip A. DuMont. Published by the Des Moines Audubon Society, 1931. Pp. 1-72. Price, 50 cents.

Besides the list of 289 species this paper gives a bibliography of twenty-two titles which deal more or less directly with the birds of Polk County. Perhaps this list is not complete, for we can name offhand three titles not in the list. Oberholser reported (1902) a specimen of *Otocoris alpestris praticola* from Polk County: Smith (1914) mentioned the Florida Gallinule in Polk County: and Bailey (1917) referred to a specimen of the supposed dark subspecies (*iowensis*) of the Broad-winged Hawk taken in Polk County. This specimen is mentioned in the catalogue, but the 1917 paper is overlooked. The author was wise in excluding (on present evidence) the Ground Dove from the list. It is rather surprising to find Swainson's Hawk listed as a "fairly common migrant": we had regarded it as rare at present in the state. The misspelling of the word "species" has been mentioned in other reviews. The paper brings together a quantity of information for one of the representative portions of the state, and lays a splendid foundation for the larger problem of a state-wide report.—T. C. S.

The Parasitic Habit in the Ducks, a Theoretical Consideration. By Herbert Friedman. Proc. U. S. Nat. Mus., Vol. 80, Art. 18, pp. 1-7. Washington, D. C., 1932.

Attention is here called to the facts that often the eggs of the European Ruddy Duck may hatch without complete incubation, and that several species of ducks have the habit of laying their eggs in the nests of other birds: for example the Argentine black-headed duck is "regularly and entirely parasitic in its reproductive activities". These facts lead to some interesting speculation as to the origin of the peculiar habits.—T. C. S.

Progress in the Western Duck Sickness Studies. By E. R. Kalmbach. Reprinted from Science, Jan. 8, 1932, Vol. 75, No. 1932, pp. 57-58.

This communication is a further report on the theory that the duck sickness is caused by the toxin of a bacillus. Previous reports (noticed in this magazine for June, 1931, p. 143) had indicated the presence of the bacillus, *Clostridium botulinum* Type C, in the tissues of birds dead from the disease and in the immediate environment of the sick birds. Now, the announcement is made that during the past year the toxin of *C. botulinum* Type C has been demonstrated in the bodies of birds dead from the disease, and also in the mud and water of their environment. These facts seem to satisfy the demands of bacteriological proof of the bacterial nature of the disease.—T. C. S.

"Check-List of North American Birds. Prepared by a committee of the American Ornithologists' Union. Fourth Edition. Lancaster, Pa. (American Ornithologists' Union) 1931. 8 vo. xix+526 pp. (Price 4 dollars).

"Under the leadership of Dr. Witmer Stone and with years of difficult work a committee of ten has prepared the long awaited Fourth Edition of the familiar 'Check-List', which is important because it not only forms the standards of nomenclature for the ornithologists of North America but also gives reliable information on the distribution of the birds of that continent at breeding-time and a survey of their migrations. The basis for the nomenclature of generic and specific names is indicated with great accuracy. In contrast with the Third Edition a number of essential revisions have proven necessary. In the arrangement of orders, families, and genera the classification worked out by Wetmore and Miller (1926) has been followed. The number of recognized genera has remained approximately as before; some genera of the Third Edition have been combined (as *Archibuteo* with *Buteo*, *Budytes* with *Motacilla*, *Astragalinus* with *Spinus*), while to about the same extent new divisions have been made (as the separation of *Moris* and *Sula*, *Phaeopus* and *Numenius*, *Thalasseus* and *Sterna*, *Melanitta* and *Oidemia*). If one draws a comparison with the nomenclature of the European ornithologists, which goes back essentially to Hartert, the fact must be admitted with regret that the gulf which separates the views on nomenclature on the two sides of the ocean is still large in spite of many attempts at approach, and that the gulf will probably not be closed very soon. This is manifested in the various decisions as to what constitutes a Genus. The Americans are far more inclined to split genera than we are, and the question arises if they are always fortunate thereby. The type of the genus *Turdus* is *T. merula* L. The American migratory thrush [Wanderdrossel=*Turdus migratorius*] is considered congeneric with our blackbird [Amsel] by the authors of the Check-List, in contrast with which they designate our red-thrush [Rotdrossel] '*Arceuthornis*' *musicus!* They call the common curlew *Numenius arquatus* (although Linnaeus wrote *Scolopax Arquata*, ex Gesner: *Arquata*); the whimbrel, or jack-curlew, on the other hand is *Phaeopus phaeopus*. The fairy tern, or shrimp-catcher [Zwergseeschwalbe=*Sterna minuta*], is placed with the picktarny [Fluszseeschwalbe=*Sterna hirundo*] in the genus *Sterna*, the Brandseeschwalbe [?] on the other hand is *Thalasseus*. Examples of that kind can be shown in still greater numbers. The agreement of the views regarding the treatment of species is equally small in innumerable cases. Here is clearly demonstrated that the European

ornithologists of the present have taken the lead in the question of the limits of species and are years ahead of their American colleagues. The latter still separate *Nettion crecca* and *N. carolinense*, *Somateria mollissima* and *S. v-nigra*, '*Astur*' *gentilis* and *A. atricapillus*, *Lagopus mutus* and *L. rupestris*, *Hirundo rustica* and *H. erythrogaster*, '*Nannus*' *troglodytes* and *N. hiemalis*, etc., as species; yes, in several cases they have even gone back beyond the point of view of the Third Edition in 'retrograde development', (for example, with *Arquatella* and *Junco!*). The goal of an internationally recognized nomenclature still lies in the distant future. In order to attain it, questions like the following must be settled for all time by general agreement: does *Eremophilus* exclude the later name *Eremophila*, and is Reichenbach's (1852) fixation of the genotype for *Colymbus* valid, etc.? The magnificent supplement 'The fossil birds of North America' from the pen of Dr. A. Wetmore is a valuable addition."—Dr. Erwin Stresemann, in *Ornithologische Monatsberichte*, Vol. 40, No. 2, March, 1932. [Translated from the German by Henry Rath].

Fall Migration of the Black Duck from Northern Michigan. By Miles D. Pirnie. Reprinted from Mich. Acad. Sci. Arts & Letters, Vol. XV, 1931, pp. 485-490.

It is here stated that the Black Duck "breeds in almost every county in Michigan". The paper is based on data obtained from banded birds. Of 845 Black Ducks banded in northern Michigan, 199 returns were secured These returns were distributed throughout the Mississippi Valley, with also a considerable number along the Atlantic Coast. The paper draws certain conclusions concerning the time of the movement and the dispersion.—T. C. S.

The Hawks and Owls of Ontario. By L. L. Snyder. Handbook No. 2, Royal Ontario Museum of Zoology. Pp. 1-48. Toronto, 1932. Price, 35 cents.

Nineteen species of hawks and eleven species of owls are treated in this pamphlet. There is a general description of each species, with a careful statement of the economic status—the latter in most cases being illustrated by a circular percentage diagram.—T. C. S.

Usefulness of Birds on the Farm. By W. L. McAtee. Farmers' Bull. No. 1682, U. S. Dept. Agric. Washington, D. C., 1932. Pp. 1-13. Price, 5 cents.

This bulletin contains much new information, and serves as a good summary of the general economic status of these birds.—T. C. S.

Food Habits and Economic Status of the Brewer and Red-winged Blackbirds. By Pablo S. Soriano. Reprinted from Calif. Fish and Game, Vol. 17, No. 4, Oct., 1931. State Fish and Game Commission, 510 Russ Bldg., San Francisco.

We find in this paper a very extensive examination into the economic status of the two species in question. Much evidence was collected, and the conclusion was reached that both species are more beneficial than harmful, and that they should be protected during the breeding season. But it was also recognized that because of their gregarious habits after the breeding season they may become locally destructive, and may then be reduced in numbers in fairness to the farmers.—T. C. S.

A Bibliography of Tennessee Ornithology. By Jesse M. Shaver. Journ. Tenn. Acad. Sci., VI, No. 4, Oct., 1931, pp. 179-190.

This list of titles contains 237 items, and we note that the greatest number of titles by one author is thirty-eight, by A. F. Ganier. Those who have not attempted it will perhaps scarcely realize the amount of work involved in assembling even an approximately complete bibliography. The publication of one is always of great value to the progress of any particular phase of science—it fixes the progress that has been made up to that point.—T. C. S.

Birds of North Louisiana. By George H. Lowery. Bull. La. Polytechnic Inst., XXIX, No. 4, 1931, pp. 1-60. Published by the Polytechnic Institute, Ruston, La.

This paper reports on 252 species and subspecies of birds observed in Louisiana north of latitude 31°. Most of the study hitherto given to the birds of this state has been made in the southern part of the state. The northern part, which seems to have been neglected, is treated in the present paper.—T. C. S.

Birds of Sioux City, Iowa. By Walter W. Bennett. Published by the Sioux City Bird Club, 1931. Price, 10 cents.

This pocket booklet of eighteen pages lists 293 species and subspecies. The evidence for a number of forms admitted is not convincing. Even if specimens are not insisted upon, the documentary evidence is not fully presented. The reviewer knows of no evidence of the former abundance (or even occurrence) of the Passenger Pigeon in the vicinity of Sioux City. The Glossy Ibis mentioned is an immature specimen, and is more probably a White-faced Glossy Ibis (*guarauna*). Perhaps a dozen other species in the list are open to question of one sort or another. For the most part, however, it is a useful list for the purposes for which it was intended.—T. C. S.

The Seasons of Birds in Central Ohio as Shown by Six Years' Migration Records. Compiled by Charles F. Walker. Published in Ohio State Mus. Bull., Vol. I (date not shown).

In this paper Mr. Walker has attempted to compile the dates of arrival and departure of the birds and from an area of central Ohio comprising all or parts of several counties, and which may be called the Columbus region. The table is based on observations obtained during the years of 1922-1927. A list of winter birds for the same region is appended.—T. C. S.

Ohio Game and Song Birds in Winter. By Lawrence E. Hicks. Bulletin of of the Bureau of Scientific Research, Division of Conservation, Vol. I, No. 2, Jan., 1932, pp. 1-68. Columbus, Ohio.

Mr. Hicks has prepared a very useful manual on the winter care of wild bird life. The subject is treated under six heads, viz., 1) emergency feeding in winter, 2) report on experimental field work, 3) conservation and checks on natural increase, 4) planting of food crops for birds, 5) list of all Ohio winter birds—to the number of 159, and 6) a bibliography of literature. Ten halftone reproductions of photographs make interesting illustrations.—T. C. S.

The California Ground Squirrel Control Program. By Eugene S. Kellogg. Calif. Dept. Agric. Special Publ., No. 109. Pp. 1-21. Sacramento, 1931.

Apparently this paper is prepared as a defense against attacks on the widespread use of poison for rodent control purposes in California and other parts of the west. The paper discusses the need of control of rodents, the occurrence in rodents of disease to which man is susceptible, and the secondary effects of poisoned bait on other forms of wild life. The paper concludes with a direct reply and criticism of the much-quoted article by Dr. Linsdale in the *Condor* last year. Innuendo is used repeatedly to asperse the validity of Linsdale's "facts", but it seems to us that the author has been careful to avoid an unequivocal denial of the facts. After all, to the general observer and conservationist it makes very little difference whether the deaths were caused by one kind of poison or another.—T. C. S.

To the *Migrant* Mrs. Sanford Duncan contributes two notes on "snakes vs. birds": in the last December number one note records that a small snake was found in a Mockingbird's nest containing eggs; in the last March (1932) number she also reports the capture of a full grown flicker by a bullsnake. Messrs. Dillon and Ganier, in the December number, record the nesting in Tennessee of the Prairie Horned Lark. The *Migrant* is an 8-page quarterly, the subscription is fifty cents per year, and the Editor is Mr. George B. Woodring, 1414 Stratton Ave., Nashville, Tenn.

In the March, 1932, number of the *Gull* Mr. C A. Harwell gives a few notes on the Water Ouzel. He records that during one period of observation "the birds submerged twelve times in twenty seconds, rested ten seconds; submerged eight times in fifteen seconds, rested twelve seconds; submerged twelve times in twenty seconds". The *Gull* is a 4-page monthly, $1.00 per year, Mrs. A. B. Stephens, Editor, 1695 Filbert St., San Francisco.

The *Audubon Annual Bulletin* (Illinois) for 1932 contains sixty-four pages of text and pictures. Two very interesting photographs attract attention, one of Benjamin F. Gault with the late Robert Ridgway, and another, a very unusual flashlight picture of a deer in the wild. Many short articles make up an excellent number.

During the past few months we have received the following mimeographed publications: the *Yellowstone National Park Nature Notes*, issued monthly in the office of the Superintendent, Yellowstone National Park, Wyoming. *The Raven*, monthly organ of the Virginia Society of Ornithology, edited by Dr. J. J. Murray, Lynchburg, Va. *The Flicker*, quarterly organ of the Minnesota Bird Club, edited by Gustav Swanson, 3305 47th Ave., S., Minneapolis, Minn. *The Chickadee*, monthly organ of the Forbush Bird Club, Worcester, Mass. This is a new periodical, but from copies we have seen we have not learned the subscription price nor business address; however Dr. W. Elmer Ekblaw, Clark University, Worcester, Mass., is president of the club and can give information. *Inland Bird Banding Notes*, quarterly organ of the Inland Bird Banding Association, Edward R. Ford, Secretary, 7077 Ridge Ave., Chicago, Ill. *News from the Bird Banders*, quarterly organ of the Western Bird-Banding Association, Museum of Vertebrate Zoology, Berkeley, Calif. *Bird Banding Notes*, issued by the Bureau of Biological Survey, U. S. Department of Agriculture, Washington, D. C.

From Our President

During this time of financial stress, it is very important that bird study and nature work be not neglected. For those who can see and hear, nature offers solace, quiet, and sanity. Never was it more essential for people to keep their feet on the ground, and to have a means of getting away for a time from the toil and strife of everyday life. Never has it been more desirable to keep up the work of organizations like the Wilson Ornithological Club, and to exert every effort to encourage people to hold their faith in the natural world, and in the world of man as well.

With these things in mind your President has been writing personal letters to the membership urging that they contribute to the resources of the Club by raising the membership rank, or in other ways. The need is a real one, but it is temporary; and we will be glad to see our organization pass through the crisis in a creditable manner. Our chief duty concerns the publication of the magazine. Can you assist?

Jesse M. Shaver, *President.*

From Our Secretary

Today many scientific and educational projects are being curtailed or abolished because of financial difficulties. Conservation, bird study, and wild life interests in general are receiving setbacks. Because of this they need our attention more now than ever before. We have but one choice—to go on.

Some of our members have been forced to discontinue. Those of us who remain must go on with increased enthusiasm. We hope that each member may do something to increase our membership. The Secretary will be glad to receive the names of any prospective members, to whom he will then extend the invitation to membership. Our organization has weathered the storm of existence for forty-four years, and there is no question of survival; but we dislike to give up ground that we have laboriously gained. If you can help, perhaps this is the time.

Lawrence E. Hicks, *Secretary.*

Annual Meetings of the Wilson Ornithological Club

	Retiring President
1914—Chicago. February 5. Chicago Academy of Sciences.	
1914—Chicago. December 29-30. New Morrison Hotel	T. C. Stephens
1915—Columbus. December 28-29. With the A. A. A. S.	T. C. Stephens
1916—Chicago. December 27-28. New Morrison Hotel	T. C. Stephens
1917—Pittsburgh. January 1-2, 1918. With the A. A. A. S.	W. F. Henninger
1918—No meeting on account of the exigencies of war	M. H. Swenk
1919—St. Louis. December 29-30. With the A. A. A. S.	M. H. Swenk
1920—Chicago. December 27-28. With the A. A. A. S.	R. M. Strong
1921—Chicago. December 26-27. The Field Museum	R. M. Strong
1922—Chicago. October 26	T. L. Hankinson
1923—Cincinnati. Dec. 31, 1923-Jan. 1, 1924. With the A. A. A. S.	T. L. Hankinson
1924—Nashville. November 28-29-30. Peabody College	A. F. Ganier
1925—Kansas City. December 28-29. With the A. A. A. S.	A. F. Ganier
1926—Chicago. November 26-27. Chicago Academy of Sciences	A. F. Ganier
1927—Nashville. Dec. 30, 1927-Jan. 1, 1928. With the A. A. A. S.	Lynds Jones
1928—Ann Arbor. Nov. 31-Dec. 1, 1928. Museum of Zoology	Lynds Jones
1929—Des Moines. December 27-28. With the A. A. A. S.	Lynds Jones
1930—Cleveland. December 29-30. With the A. A. A. S.	J. W. Stack
1931—New Orleans. December 28-29. With the A. A. A. S.	J. W. Stack

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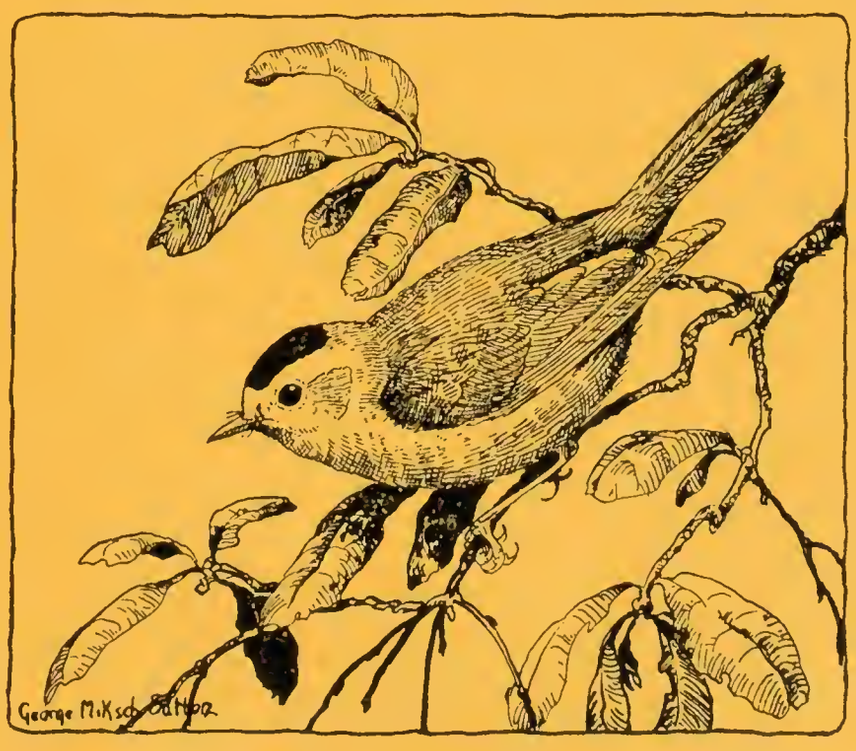

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THE WILSON BULLETIN

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All articles and communications for publication, books and publications for notice, and exchanges, should be addressed to the Editor.

Claims for lost and undelivered copies of the magazine may be addressed to the Editor.

THE WILSON ORNITHOLOGICAL CLUB

Founded December 3, 1888. Named after Alexander Wilson, the first American ornithologist, and called the "Father of American Ornithology."

The officers for the current year are:

President—Prof. J. M. Shaver, George Peabody College for Teachers, Nashville, Tenn.
First Vice-President—Prof. E. L. Moseley, State Teachers College, Bowling Green, Ohio.
Second Vice-President—Dr. Josselyn Van Tyne, Museum of Zoology, Ann Arbor, Mich.
Treasurer—Mr. W. M. Rosene, City State Bank, Ogden, Iowa.
Secretary—Mr. Lawrence E. Hicks, Botany Dept., O. S. U., Columbus, Ohio.
Editor—T. C. Stephens, Morningside College, Sioux City, Iowa.

The membership dues are—Sustaining membership, $5.00; active membership, $2.50; associate membership, $1.50 per year.

The following societies are affiliated organizations:

The Nebraska Ornithologists' Union.
The Iowa Ornithologists' Union.
The Kentucky Ornithological Society.
The Tennessee Ornithological Society.

THE WILSON BULLETIN

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A STUDY OF MERRIAM'S TEMPERATURE LAWS*

BY S. CHARLES KENDEIGH

In 1894, Dr. C. Hart Merriam, of the United States Bureau of Biological Survey, formulated laws of temperature control for the northward and southward distribution of terrestrial animals and plants. At the time that these laws were formulated, they were, undoubtedly, the best statement of the known effect of temperature on limiting distribution. Much work of an ecological nature has since been done, however, and a reëxamination of these laws is needed.

Statement of Temperature Laws

General Considerations. Dr. Merriam was concerned only with the factors of climate which are effective in limiting the distribution of plants and animals during the season of growth and reproduction, which is the open or summer season. He assumed that this season is the only part of the yearly cycle in which temperature exerts a limiting effect upon the distribution of plants and animals, as at other seasons sensitive organisms either become dormant, go into hibernation, or migrate.

Largely on the basis of previous work in the field, Merriam assumed that temperature is by far the most important factor limiting the northward and southward distribution of organisms. He then endeavored to determine which phase of temperature was the critical one by ascertaining what isotherms, when plotted on a large scale map of North America, most nearly agreed with the boundaries of his biotic units, the "life zones", then also in the formative period. The life zones represented unit areas of distribution, each characterized by possessing peculiar genera of animals and plants. If certain isotherms agreed with the boundaries of the life zones, then those isotherms, he argued, must represent the true factor of temperature which controlled the distributional limits of the animals and plants contained therein.

*Contribution from the Baldwin Bird Research Laboratory (No. 23) and Western Reserve University, Cleveland, Ohio.

First Temperature Law. After trying and discarding the use of mean temperature for the reproductive period, use was made of the century-old idea of summation of temperatures. This idea is based upon the belief "that the same stage of vegetation is attained in any year when the sum of mean daily temperatures reaches the same value". A method of summing mean daily temperatures was worked out, and temperature summations were determined for a large number of stations scattered across the continent. When lines (isotherms) were drawn connecting localities with equal sums of temperature, these lines coincided satisfactorily with the northern boundaries of the life zones. He therefore formulated his first temperature law, "*Animals and plants are restricted in northward distribution by the total quantity of heat during the season of growth and reproduction*".

Second Temperature Law. Although these isotherms, so drawn, appeared to agree fairly well with the northern limits of distribution of plants and animals in the life zones, they did not coincide so closely with the southern limits of more northerly forms, notably near the Pacific coast. Wishing to determine the effective phase of temperature which limits the southward distribution of animals and plants, Merriam next plotted the mean daily temperature of an arbitrary period of six weeks during the hottest part of the summer. Isotherms formed from these data agreed with the southern boundaries of the life zones. This led to the formulation of the second temperature law, "*Animals and plants are restricted in southward distribution by the mean temperature of a brief period covering the hottest part of the year*".

Table of Zone Temperatures. Included in his paper is a table giving the critical temperatures which are supposed to limit the northward and southward distribution of organisms. For instance, the northern limit of the Transition Life Zone is determined by a sum total of mean daily temperatures amounting to approximately 10,000° F., the Upper Austral Zone by 11,500° F., the Lower Austral Zone by 18,000° F., and the Tropical Zone by 26,000° F. The southern limit of the Arctic Zone is determined, he supposed, by a normal mean temperature of 50° F. during the six hottest consecutive weeks, the Hudsonian Zone by 57.2° F., the Canadian Zone by 64.4° F., the Transition Zone by 71.6° F., and the Upper Austral Zone by 78.8° F.

Importance of Humidity. Three of the life zones were later divided at about the 100th meridian into eastern and western portions. This was based largely upon a very noticeable difference in humidity.

The east and west divisions are, however, of subordinate rank compared with the zonation north and south.

Acceptance of Laws. These temperature laws were accepted by some biologists, particularly by ornithologists and mammalogists, but not so generally by other zoologists nor by botanists.

The First Temperature Law

It is necessary to consider each temperature law separately, since they are quite different, and criticisms applied to one do not necessarily apply to the other. The first temperature law assumes that summed daily temperatures during the reproductive season control northward distribution.

Season of Temperature Effectiveness. The reproductive and growing season is not, as Merriam supposed, the only time when temperature may be effective in controlling the distribution of animals and plants. Even though some of those forms which do not migrate may become dormant in winter, they are still not insensitive to extreme climatic conditions.

Shreve (1914) studied the relation of winter temperatures to the vertical distribution of vegetation in Arizona and found that "the greatest number of consecutive hours of freezing temperature is the factor most closely corresponding in its distribution, with the limitation of the species concerned". Experimental work with succulent species showed that those which have the lowest vertical limit of distribution were unable to resist freezing over 19 to 22 hours in duration. According to Salmon (1917), the isotherm of 10° F. for the daily minimum temperature of January and February coincides, in general, with the boundary of winter wheat culture in the United States. Northern evergreen trees resist winter-killing by increasing the osmotic pressure and water-retaining capacities of their leaves (Gail, 1926). Some plants are capable of initiating hardening processes to enable them to withstand low temperatures, while others are not (Rosa, 1921).

Hardening, to resist low winter temperatures, occurs also in some species of insects (Payne, 1926). This enables certain species to survive in regions where others, lacking this capacity, can not do so. Sanderson (1908) made a particular study of the influence of winter temperature in controlling the northward distribution of insects. He found that several species are absent from regions where the summation of temperatures during the summer is amply sufficient to allow their reproduction, but where minimum winter temperatures do not permit their survival, even though they are in hibernation.

With birds that migrate south for passing the winter, temperature is undoubtedly of significance in limiting their breeding range only during the open season. However, the wintering range of these birds may often be influenced as much by temperature as is the breeding range and in a similar manner (as in the case of *Troglodytes aedon aedon*), so that temperature is effective, as far as the birds are concerned, at all seasons of the year. Likewise, with birds and mammals which have never acquired the habit of migration but are permanent residents in a region, low temperatures of winter are of utmost importance and undoubtedly exert at that time as much or more influence in determining the distributional limits of the species than they do in the summer. These points are strongly substantiated in a paper which we have ready for publication but unable to include here (Kendeigh, Ms.).

In temperate regions, seasonal changes in the aspects of biotic communities is one of the most striking of ecological phenomena. Nearly all animals and plants undergo differences in behavior and physiology as the winter season comes on. This may be merely an increase in the resistance to low temperatures which occurs in evergreen trees, cold-blooded organisms, and in those birds and mammals which remain active in the region throughout the year. Or it may consist in the shedding of the sensitive leaves of deciduous trees, the production of seeds and dying down of annual plants, the going into hibernation of mammals and cold-blooded animals, or the migrating of birds. Species vary in their responses and resistances. Those that can not make the necessary adjustments can not exist, and so are not found in the regions where unfavorable conditions occur at some time during the year. Temperature must certainly be considered as effective at any time of the year, not just during the reproductive period. A temperature law that does not take this into consideration obviously can not be a complete nor even a true statement of the controlling role of temperature in distribution.

Significance of Isotherms. Merriam found a rather close agreement between the isotherms of accumulated daily temperatures with the northern boundaries of his life zones. This, he maintained, was a proof that they were the effective temperatures involved in limiting northward distribution. That this is not necessarily so is shown by the work of others.

Livingston and Shreve (1921), also using the cartographic method in much the same way that Merriam did, attempted to analyze the temperature factor in all its phases as it affects the distribution of

plants. They considered Merriam's temperature laws and life zones in detail. The aspects of the temperature factor which they considered were: duration of average frostless season; duration of average frost season; length of period of high daily mean temperatures; length of period of low daily mean temperatures; summation of daily mean temperatures above 0° F., 32° F., 39° F., and 50°F.; summation of exponential indices of temperature efficiency; summation of physiological indices of temperature efficiency; absolute temperature maxima; absolute temperature minima; average daily temperature during fourteen coldest days of year; Merriam's average temperature during hottest six weeks of year; and mean annual temperature. With all of these different aspects of the temperature factor, they found an east and west zonation of temperature across the continent. By selecting the proper isotherms, agreement in nearly all instances with the boundaries of the life zones can be had in a rough way. The selection of any one of these phases of the temperature factor, to the exclusion of the rest, as the effective one in controlling distribution, is not warranted without a basis in the physiological and behavior responses of the organisms concerned. This is the next point that needs to be considered here.

Summing Temperatures. Probably Merriam was right in assuming that the completion of any growth stage or mature organism requires a certain more or less definite amount of energy transformation. Krogh (1914) found this to be true for the pupal development of a beetle, *Tenebrio*, as measured by the total carbon dioxide output, and this output is not directly proportional to the temperature. In regions where the season is too short to allow the accumulation of the necessary amount of energy for the development of an organism, that organism could not, of course, be a regular member of the biota there. One may easily imagine that this may be one out of several factors effective in limiting the distribution of cold-blooded (poikilothermic) organisms (but not warm-blooded or homoiothermic ones as will be shown later). The difficulty comes in developing methods for computing this energy.

Merriam attempted to compute this energy requirement by the direct summing of daily mean temperatures above a certain threshold. Merriam quotes DeCandolle's work in 1835 as showing that wheat does not germinate at temperatures below 43° F. (6° C.), and so this temperature is the threshold for development in this species. Assuming that this temperature threshold is the same for all plants and animals and in all localities, Merriam's idea was to substract 43° F.

(6° C.) from the mean temperature for each day during the entire reproductive season. These temperature remainders would all be added together, and the resultant figure was to represent the total heat (in degree-days) available for development. By summing the effective temperatures in this way at a large number of stations he could arrive at totals characteristic of each life zone. Since different species of plants and animals apparently require different amounts of heat (energy) for their development, those that require the most would, he argued, be confined to the more southern life zones, while those that could get along with less would flourish in the more northern life zones. This is the physiological assumption for his first temperature law, the errors in which are pointed out in detail by Shelford in the succeeding paper.

However, there are criticisms that may be brought against this method of computing the total heat or total energy required for development in addition to those discussed by Shelford. The first of these is in regard to the selection of 43° F. (6° C.) as a threshold for development. The temperature threshold of development and activity is not the same for all organisms. Sanderson and Peairs (1913) estimated that the threshold value for the development of insect eggs and pupae varied from 37° F. to 52° F. in the case of different species. DeCandolle, himself, is quoted to have found seeds of some plants germinating at 32° F. while others, as corn, did not do so below 48° F. In the case of the development of eggs of the domestic fowl, the threshold temperature is 68° F. (Edwards, 1902). Likewise the initiation and termination of dormancy (hibernation and aestivation) in mammals has been found to occur at different temperatures and under different conditions (Johnson, 1931).

The temperature threshold may not be a constant value even within the same species. Shelford (1927) found that in the development of the codling moth the true temperature threshold is not a fixed point but varies, within certain limits, with the humidity and other weather factors, and also with the generation and the individual. For the larva, it was found to vary from 43° to 48° F.; for the pupa and egg, from 44° to 49° F.; and for the hibernated larva, from 43° to 50° F. We have reason to believe, also, that the temperature threshold is lower for plants and animals at high latitudes and altitudes than it is for those living in warmer regions. The error of selecting at random the threshold value for one species to hold for all forms in all localities is therefore manifest.

The table of summed daily temperatures (discussed above) which Merriam presents in his paper and which was used as the basis for drawing his isotherms is incorrect. This was due to a misunderstanding with the U. S. Weather Bureau, which computed the temperatures. The error in these computations was not discovered until later (Merriam, 1899), and no corrected table has since been published. The temperatures were summed above a threshold of 32° F. (0° C.) instead of 43° F. (6° C.), although only for days when the mean temperature arose above 43° F. (6° C.). Consequently the table of summed temperatures which Merriam gives is much too high, as Shelford points out graphically in the succeeding report. The agreement between Merriam's isotherms and the boundaries of the life zones is not a proof, therefore, of the correctness of his arguments—rather the contrary.

Various methods have been devised for summing temperatures above a definite threshold. The earliest method, and that which Merriam used, was formulated by Reaumur (1735) who summed temperatures above freezing for the years 1734 and 1735 and correlated these temperatures with the difference in the time of appearance of plants and animals during these two years.

From the practical standpoint, this method is criticized because the sums which it yields are too variable. Seeley (1917) summed temperatures above 43° F. from January 1 to the date of ripening of the Crawford peach at Wauseon, Ohio, for the years 1883 to 1912. He obtained sums during certain years as widely different as 3030° and 4347° F. He therefore declares that this method has no great value. He further emphasizes the importance of considering the temperature of the plant itself rather than of the air when studying the influence of temperature on growth. Likewise, Hunter and Hooker (1907) determined the total "effective temperatures" for the hatching of eggs of the cattle tick, by direct summing of temperatures above 43° F., and found that eggs laid from September 15 to October 15 require a total of 837.6° to 1510.8° F. to hatch, while those laid in April and May require 981.6° to 1139.1° F.

Livingston and Shreve (1921) and Shelford (1927, 1929) have severely criticized from the physiological viewpoint the method of direct summing of air temperatures for ascertaining the accumulation of energy for development. This is based on the fact that the rate of development varies widely at different temperatures. The inaccuracy of the method of direct temperature summation is fully dealt with in the following paper and so will not be discussed further here. The

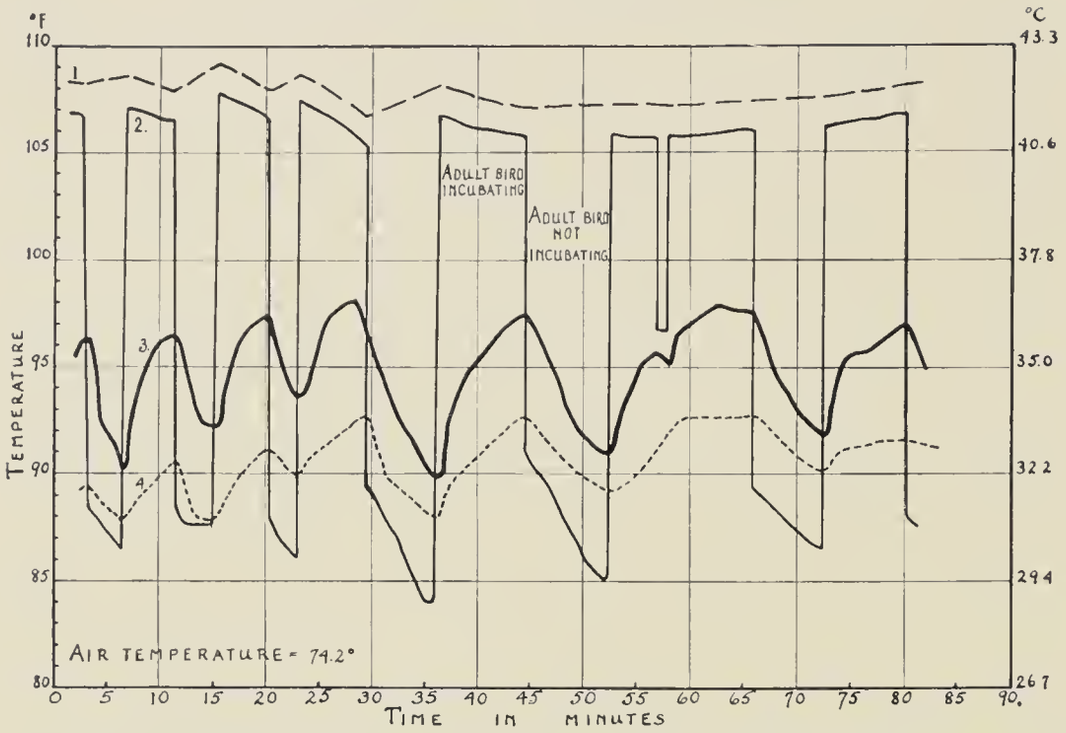

FIG. 27. Natural fluctuations in temperature of a House Wren egg under normal conditions in the nest. Curve 1 represents the body temperature of the adult bird; curve 2 is the temperature in the nest above the eggs, both when the bird is incubating and when she is away; curve 3 shows the temperature of the egg; and curve 4 shows the temperature in the nest beneath the eggs.

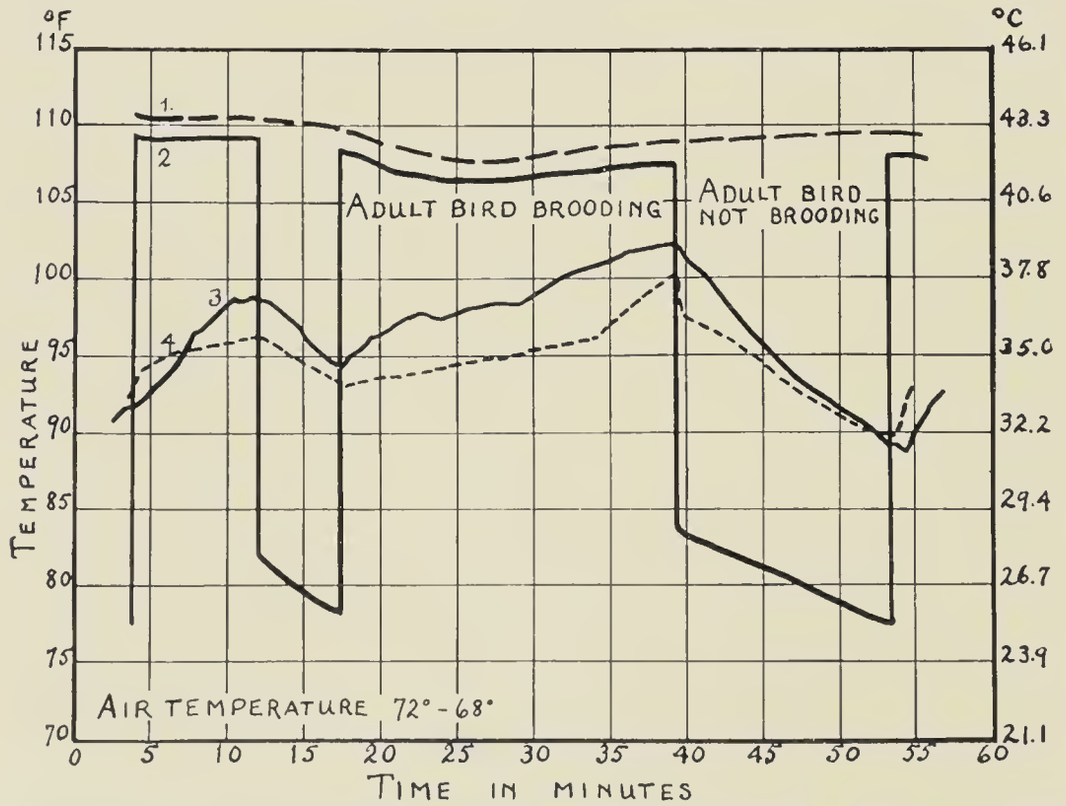

FIG. 28. Natural fluctuations in temperature of a House Wren nestling under normal conditions in the nest. Curve 1 shows the body temperature of the adult bird; curve 2 shows the temperature in the nest above the nestling, both when the adult bird is brooding and when she is away; curve 3 shows the temperature of the nestling; and curve 4 is the temperature of the nest beneath the nestling.

eomplexity of the problem is evident, and mueh more work needs to be done before the aetual limiting effeet of "total heat" during the season of reproduction may be adequately eonceived.

Temperature Tolerance by Birds. A eertain rather definite total of energy is probably as neeessary for eomplete embryonie development of birds as it appears to be for the development of other animals (Krogh, 1914; Shelford, 1927). Bohr and Hasselbalch (1900) measured the rate of carbon dioxide output at all stages of the development of the domestie fowl, and similar studies have been performed by others (see Needham, 1931). The subjeet is eapable, therefore, of experimental proof and measurement. Bird's eggs develop to hatehing within a narrow temperature range. They are dependent, therefore, upon suitable eonditions for maintaining them within this range.

Merriam's temperature law assumes that a sum of environmental temperatures is required before this total energy required by the bird's egg for development ean be obtained. Actually, however, the temperature of the bird's egg in the nest is maintained several degrees above that of the air and is relatively unaffeeted by outside environmental temperatures. This is well shown in figure 27, whieh is taken from a forthcoming paper (Baldwin and Kendeigh, 1932) where the subject is diseussed in detail. Likewise, the temperature of nestling birds is not direetly dependent upon that of the outside environment (Fig. 28). The reason for this is that the adult birds have evolved a eomplieated nest and reproduetive behavior that keeps nest eonditions, partieularly those involving temperature, at what is probably the optimum for the speeies. As long as the adult birds are able to survive and earry on normal aetivities in a region, they can maintain the requisite eonditions required for the proper development of the young regardless of any aeeumulation of environmental temperatures without. This eonstitutes one important difference in the developmental history of warm-blooded and eold-blooded organisms, since the latter alone are directly dependent upon environmental temperatures for furnishing the energy needed in development. Thus summed environmental temperatures, even if such summed temperatures could be eorrectly determined in a significant manner, eannot possibly limit the distribution of birds through affecting development. Temperature appears to limit the northern distribution only when it affeets the adult, and here other aspects of temperature are more important.

Some ornithologists have interpreted Merriam's laws as meaning that a certain sum of environmental temperatures during the season is

required before the adult bird is able to complete its entire nesting cycle. This idea is without adequate physiological basis for warm-blooded animals. As long as temperatures are above the limit of tolerance for the existence and carrying on of normal activities by the adult birds, the exact degree of heat, while it has some importance, is not of primary significance. Birds have been found in our studies of body temperature regulation to have efficient physiological mechanisms that compensate for variations in environmental temperatures and maintain constant body temperatures (Baldwin and Kendeigh, 1932).

The length of the season when temperatures are above the threshold for development and activity of cold-blooded animals and of plants or above the limit of tolerance for adult birds and mammals is quite a different matter from the summation of daily temperatures during this period. The season may be too short for allowing the completion of the entire reproductive cycle of activities. This may conceivably determine whether the bird will raise each season two broods, one brood, or none at all. It is only when the temperatures go beyond the limits of tolerance that birds are incapable of reproducing or of existing in the region and are limited in their distribution.

Birds possess a limit of tolerance to low air temperature when this factor acts in conjunction with long periods of time during which the obtaining of food is difficult. We have made an intensive study of temperature resistance of birds (Kendeigh, Ms.). These studies indicate that the average night temperature combined with the number of hours of darkness, when the procuring of food is impossible for most birds, are crucial and critical factors involved in controlling the northward distribution, the migration, and the abundance of birds. This is particularly true of the smaller passeriform species. Larger and heavier birds may have a greater resistance to low temperature than do the smaller birds, and this can be measured. Some factors other than temperature are correspondingly more important with the larger birds than the smaller ones, although other factors must be considered also in the case of all species.

Other Factors. Other factors aside from temperature may be of more or less critical importance in limiting the distribution of plants and animals. Undoubtedly, different factors have diverse degrees of importance with different species. It is advisable to study each of these other factors separately for each species of birds before broad generalizations be made concerning whole faunas. Our own experiments with birds emphasize the importance of such other factors as

relative length of day and night, intensity of solar radiation, vegetation, food, and biotic competition (Kendeigh, Ms.). Livingston and Shreve (1921) have discussed the importance of many different factors in relation to the distribution of plants; Grinnell (1914, 1917, 1928) and Howell (1922, 1924) have done the same for mammals and also birds.

Summary. The criticisms against Merriam's first temperature law as it applies to both animals and plants may be summarized as follows:

(1) Temperatures at other times of the year than the season of growth and reproduction may be effective in limiting the northward distribution of organisms.

(2) The mere cartographic agreement between particular lines of equal temperature (isotherms) and boundaries of life zones or other biotic areas does not in itself without adequate physiological basis constitute proof that such particular factors are the critical ones limiting distribution.

(3) The physiological basis of summing temperatures, which Merriam used, is without significance because (a) the temperature threshold of development varies widely in different species, and so, no one value which is not an average for each locality can be used; (b) temperatures, as they affect in a significant manner the development of plants and animals, cannot be summed directly because of marked differences in the rate of development at different temperatures; and (c) no distinction between cold-blooded and warm-blooded organisms is made in the possible effect of environmental temperatures upon development.

(4) The actual statistical climatic data used by Merriam to support his arguments and to prove the relation between temperature and the distributional boundaries of the life zones were incorrectly determined.

(5) Other phases of the temperature factor or other factors aside from temperature are of importance in limiting the northward distribution of animals and plants.

The Second Temperature Law

The arguments concerning Merriam's second temperature law will be only briefly summarized here. This law states that the southward distribution of plants and animals are limited by the mean temperature during the hottest part of the summer.

Isotherms. The same criticism which holds against the method of Merriam in demonstrating the first temperature law applies also in the case of the second temperature law. The mere agreement between

particular isotherms and limits of distribution does not, without adequate experimental and physiological basis, constitute proof that such factors are the most critical or controlling ones.

Maximum Temperatures. In our study of the physiology of bird temperatures (Baldwin and Kendeigh, 1932), we found that variations in the mean temperature of the air from day to day have very little effect upon body temperatures of birds, even during the hottest period of the summer. However, during periods lasting from one to a few hours, the temperature of the bird may rise and normal nesting behavior be greatly disturbed due to exposure to the sun or to maximum daily air temperatures. Experiments performed with English Sparrows (*Passer domesticus domesticus*) and Eastern House Wrens (*Troglodytes aedon aedon*) indicate that high air temperatures become significant only when they get as high as 93° F. (Kendeigh, Ms.). At air temperatures above this degree the resistance time of birds decreases, body temperature may rise, the general metabolism is abnormally disturbed, and normal reproductive behavior interferred with. These two species of birds frequently survive air temperatures above 93° F., but only when these temperatures are maintained for relatively short periods each day and only by modifying their normal behavior. Birds have, therefore, upper limits of temperature tolerance as well as lower limits, and these are effective in controlling distribution (Kendeigh, Ms.).

However, these high air temperatures usually do not persist for more than a few hours each day. They are the maximum daily temperatures. The mean daily temperature, even during the hottest part of the summer, is considerably lower, because the nights are cooler. On the basis of these experimental results and careful analysis of the temperature factor in the field, the conclusion appears warranted that the maximum daily temperatures, rather than the mean, are more important in controlling the southward distribution of birds. We may suppose that the same is true with other kinds of organisms.

Other Seasons. Merriam limited the influence of high temperature to the hottest part of the year (six weeks). While high temperature is undoubtedly of considerable significance at this time, especially in the control of the breeding range, its possible effect at other seasons must not be excluded. High temperatures may have an influence in determining the southward distribution of northern birds in the winter, although there is little conclusive evidence on this point. Likewise, during both the spring and fall migrations, the distribution of a species at any one time may be influenced by high temperatures.

Other Factors. Mention needs to be made again that other factors aside from temperature (such as those enumerated above) may often exert an important role in controlling the distribution of birds and other organisms, even in a southerly direction (Grinnell, 1914, 1917, 1928; Howell, 1922, 1924; Kendeigh, Ms.; Livingston and Shreve, 1921).

Summary. The arguments against Merriam's second temperature law maintain that:

(1) The mere agreement between isotherms and the distributional boundaries of life zones is not proof without adequate physiological basis that such factors are the controlling ones in distribution.

(2) Daily maximum temperatures are more important than daily mean temperatures in controlling the southerly distribution of birds and probably other organisms.

(3) High temperature may influence the distribution of organisms at other seasons of the year than just the six hottest weeks during the summer.

(4) Factors other than temperature are also important.

Temperature Laws and Life Zones

If Merriam's temperature laws can not be accepted and used, the question may be raised as to what effect this will have upon the reliability of the "life-zone" concept and the maps of life zones that have been made by ornithologists and mammalogists.

It is difficult to estimate to what extent these temperature laws have influenced the mapping of life zones. It is certainly true that Merriam published two life zone maps of North America (Merriam, 1890, 1892) before he definitely published the temperature laws in 1894. The earlier maps seem to have been based largely upon the known distribution at that time of genera of plants and animals, although the importance of temperature was even then appreciated. Certain modifications in the maps published in 1894 and later years suggest that after the isotherm map was made, secondary changes in the boundaries of the life zones may have been thought advisable. Only in so far as the life zones are based upon these temperature formulae of Merriam, is their inadequacy questioned at this time. If the life zone concept is to continue to exist, it must be entirely upon the basis of the actual distribution of animals and plants. Recent maps of life zones appear, as far as we can judge, to be based largely upon actual distribution of organisms, although the organisms selected to characterize the different life zones are frequently of such minor

importance and abundance as to be without significance for correlations with climatic conditions.

Conclusions

1. Merriam's two laws of temperature control for the northward and southward distribution of animals and plants cannot be accepted.

2. The life zone concept, in order to survive, must be based upon the actual distribution of important and significant animals and plants in nature and not upon climatic factors of uncertain preconceived importance.

Literature Cited

Baldwin, S. Prentiss and Kendeigh, S. Charles.
1932. Physiology of the temperature of birds. (In press). Publication Cleveland Museum Natural History.

Bohr, C., and Hasselbalch, K. A.
1900. Ueber die Kohlensäureproduction des Hühnerembryos. Skandinavisches Archiv für Physiologie, Bd. 10, S. 149-173.

Edwards, Charles Lincoln.
1902. The physiological zero and the index of development for the egg of the domestic fowl, *Gallus domesticus*. American Journal of Physiology, Vol. VI, No. VI, pp. 351-397.

Gail, F. W.
1926. Osmotic pressure of cell sap and its possible relation to winter killing and leaf fall. Botanical Gazette, Vol. 81, pp. 434-445.

Grinnell, Joseph.
1914. Barriers to distribution as regards birds and mammals. American Naturalist, Vol. XLVIII, pp. 248-254.
1917. Field tests of theories concerning distributional control. American Naturalist, Vol. LI, pp. 115-128.
1928. Presence and absence of animals. University of California Chronicle, October, pp. 429-450.

Howell, A. Brazier.
1922. Agencies which govern the distribution of life. American Naturalist, Vol. LVI, pp. 428-438.
1924. Theories of distribution—a critique. Ecology, Vol. V, No. 1, pp. 51-53.

Hunter, W. D. and Hooker, W. A.
1907. The North American fever tick. U. S. Bureau of Entomology, Bulletin 72.

Johnson, George E.
1931. Hibernation in mammals. The Quarterly Review of Biology, Vol. VI, No. 4, pp. 439-461.

Kendeigh, S. Charles.
—— The role of the environment in the life of birds. Manuscript.

Krogh, August.
1914. On the rate of development and CO_2 production of chrysalides of *Tenebrio molitor* at different temperatures. Zeitschrift für allgemeine Physiologie, Bd. 16, S. 178-190.

Livingston, Burton E. and Shreve, Forrest.
1921. The distribution of vegetation in the United States as related to climatic conditions. Publication Carnegie Institution, Washington, No. 284, pp. 1-585.

Merriam, C. Hart.
1890. Results of a biological survey of the San Francisco Mountain region and desert of the Little Colorado, Arizona. North American Fauna No. 3, U. S. Department of Agriculture.
1892. The geographic distribution of life in North America with special reference to the Mammalia. Proceedings Biological Society of Washington, Vol. 7, pp. 1-64.
1894. Laws of temperature control of the geographic distribution of terrestrial animals and plants. National Geographic Magazine, Vol. VI, pp. 229-238.
1899. Zone temperatures. Science, N. S. Vol. IX, No. 212, p. 116.

Needham, Joseph.
1931. Chemieal embryology. Cambridge.

Payne, Nellie M.
1926. The effect of environmental temperatures upon insect freezing points. Ecology, Vol. VII, pp. 99-106.

Reaumur, R. A. F. de
1735. Observations du thermometre. Acad. Roy. des sci. des Pays-Bas Mem., pp. 737-754.

Rosa, J. T.
1921. Investigations on the hardening process in vegetable plants. Research Bulletin No. 48, Agricultural Experiment Station, University of Mississippi.

Salmon, S. C.
1917. The relation of winter temperature to the distribution of winter and spring grains in the United States. Journal American Society of Agronomy, Vol. 9, pp. 21-24.

Sanderson, E. D.
1908. The influence of minimum temperatures in limiting the northern distribution of insects. Journal of Economic Entomology, Vol. 1, pp. 245-262.

Sanderson, E. D. and Peairs, L. M.
1913. The relation of temperature to insect life. New Hampshire College of Agriculture Experiment Station, Technical Bulletin No. 7.

Seeley, D. A.
1917. Relation between temperature and crops. Monthly Weather Review, Vol. 45, pp. 345-359.

Shelford, Victor E.
1927. An experimental investigation of the relations of the codling moth to weather and climate. Bullctin State Natural History Survey of Illinois, Vol. XVI, Art. V, pp. 311-440.
1929. Laboratory and field ecology. Baltimore.
1932. Life zones, modern ecology, and the failure of temperature summing. Wilson Bulletin, Vol. XLIV, Sept., 1932, pp. 144-157.

Shreve, Forrest.
1914. The role of winter temperatures in determining the distribution of plants. American Journal of Botany, Vol. 1, pp. 194-302.

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LIFE ZONES, MODERN ECOLOGY, AND THE FAILURE OF TEMPERATURE SUMMING*

BY VICTOR E. SHELFORD

I. Introduction.

II. Fundamental Basis of Merriam's Work.

III. Relation to Physical Conditions.
1. Merriam's View.
2. Experimental Results.
3. Analysis by students of plants.

IV. Relations of the Zones to Communities and the Major Facts of Distribution.

Introduction

There is a large degree of confusion as to the relations of life zones as originally described by Merriam, and the plant-animal communities recognized in modern ecology. There are two points of view in the study of distribution: (1) the faunistic-floristic view which bases its principal regions on genera, is purely qualitative and aims at the discovery of facts bearing upon evolution and migration as considered in this field; (2) the ecological point of view which bases its communities (regions) upon species and varieties, is purely quantitative, evaluating all important organisms on the basis of quantity and individual potency, and aims at the discovery of facts bearing on dynamic life relations of all kinds—fluctuations in abundance, competition, invasion, succession, etc. In order to compare this viewpoint with that of Merriam and his followers, it is necessary to go back to the initial thesis of Merriam (1891) and trace its later developments.

Fundamental Basis of Merriam's Work

Merriam began his work as strictly a faunistic study. His remarks in his original presentation of his subject were directed mainly as a criticism of Wallace (*Geographical Distribution of Animals*, 1876), whose distribution of regions is shown in figure 29. Zoogeographical regions as worked out by Wallace and many others are based upon genera or families, no consideration being taken of the abundance, habitats, or habitat relations of the animals. The aim was to clarify (historical) evolution, migration, and barriers. Merriam set out to prove that Wallace's mapping is incorrect, constructing a table given below (Fig. 30).

*Contribution from the Zoological Laboratories, University of Illinois, No. 426.

FIG. 29. The sub-regions of Wallace, 1876.

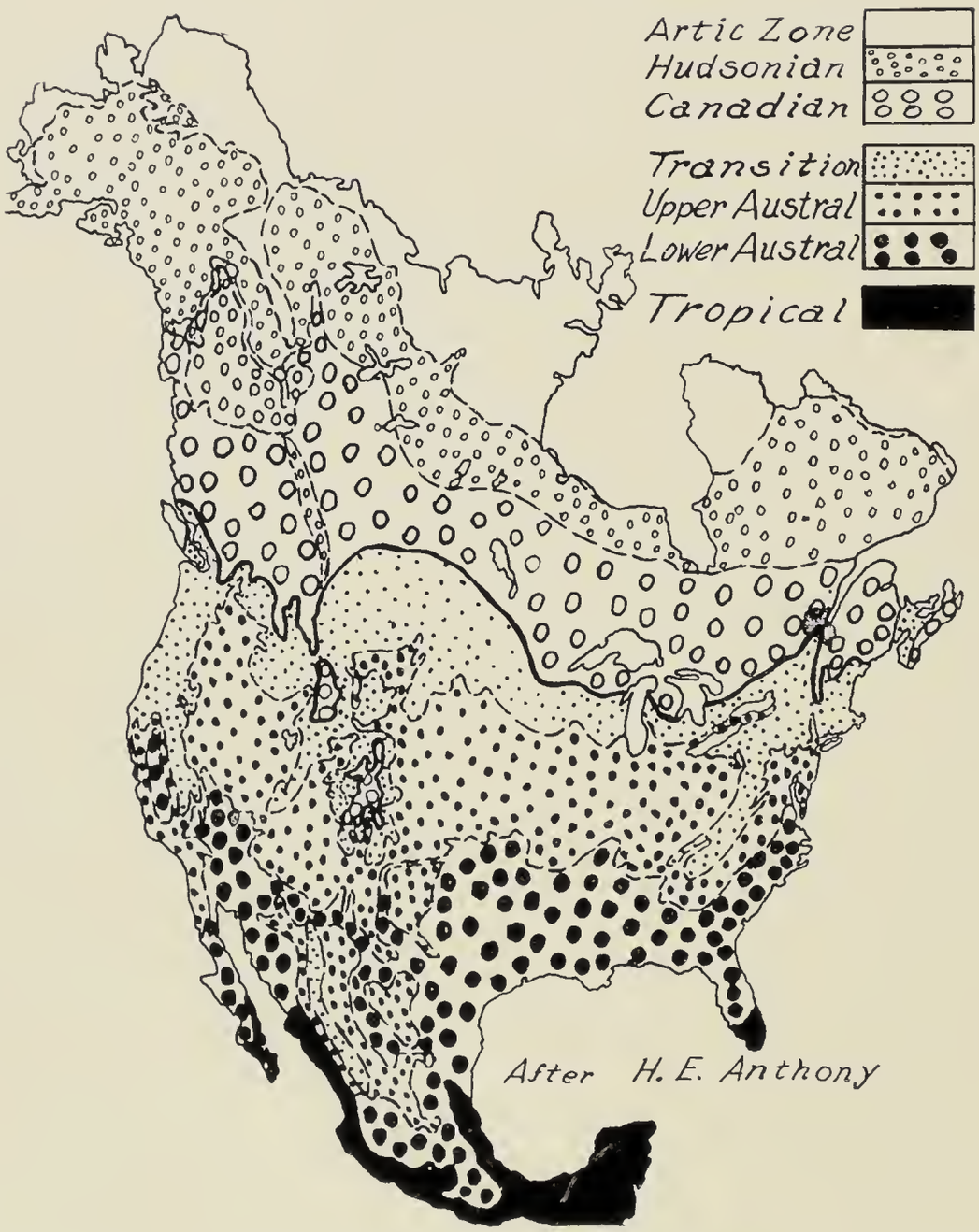


FIG. 30. Merriam's Life Zones, after Anthony.

TABLE I.

Generic Basis of Zones.

	Mammals		Birds		Total	
	Families	Genera	Families	Genera	Families	Genera
Arid Sonoran distinguished from humid Sonoran by.....	1	10	0	24	1	34
Humid Sonoran distinguished from arid Sonoran by.....	1	4	0	7	1	11
Common to both arid and humid Sonoran	13	27	12	31	25	58
Sonoran as a whole distinguished from Boreal by.....	8	41	10	100	18	141
Boreal as a whole distinguished from Sonoran by.....	6	30	3	40	9	70
Common to Boreal and Sonoran	8	8	....	18	....	26

In this table Merriam showed that more genera are different from north to south than from east to west. The comparison is made between his Boreal and his Sonoran regions for the north and south difference and between the arid and humid portions of the Sonoran for the east and west difference. This agrees with Wallace in one feature of the latter's classification, but disputes his division into Californian, Rocky Mountain, and Alleghanian areas, as shown in Wallace's map (Fig. 29). In other words he practically called Wallace's 1, 2, and 3 (Fig. 30) *Sonoran* and Wallace's Canadian, *Boreal*. He then used these conclusions to disprove the subdivision into Californian, Rocky Mountain, and Alleghanian sections, but presented no table to establish his three transcontinental divisions, namely the Transition, upper Sonoran (or Austral) and lower Sonoran (or Austral). He contended, however, that within the Sonoran zone there are more generic differences from north to south than from east to west. In other words genera, which are the basis of the first subdivision of the large zoogeographical regions, range cross-wise of the North American continent.

RELATIONS TO PHYSICAL FACTORS

1. Merriam's view and method. He had noted correlations between isotherms and distribution limits of birds and mammals, and contended that their limits coincide with certain temperature phenomena, particularly the total temperature above 6° Centigrade (approximately 43° F.). He insisted that temperature is the most important limiting factor, though no experiments were performed and no inquiries as to the method of its operation were undertaken. His sums of temperatures were calculated by the Weather Bureau. Through some error, those given him for publication were not calculated above 6° C. but above zero Centigrade, with all days in which the mean did not reach 6° C., *omitted*. A note was published in *Science* calling at-

tention to this error (Merriam '99), but the new totals were never substituted. The sums published are, therefore, unlike those compiled elsewhere.

This assumption of the sum of temperatures had received considerable attention in the few decades preceding the announcement of the Life Zone idea. Merriam, however, merely took the relation for granted

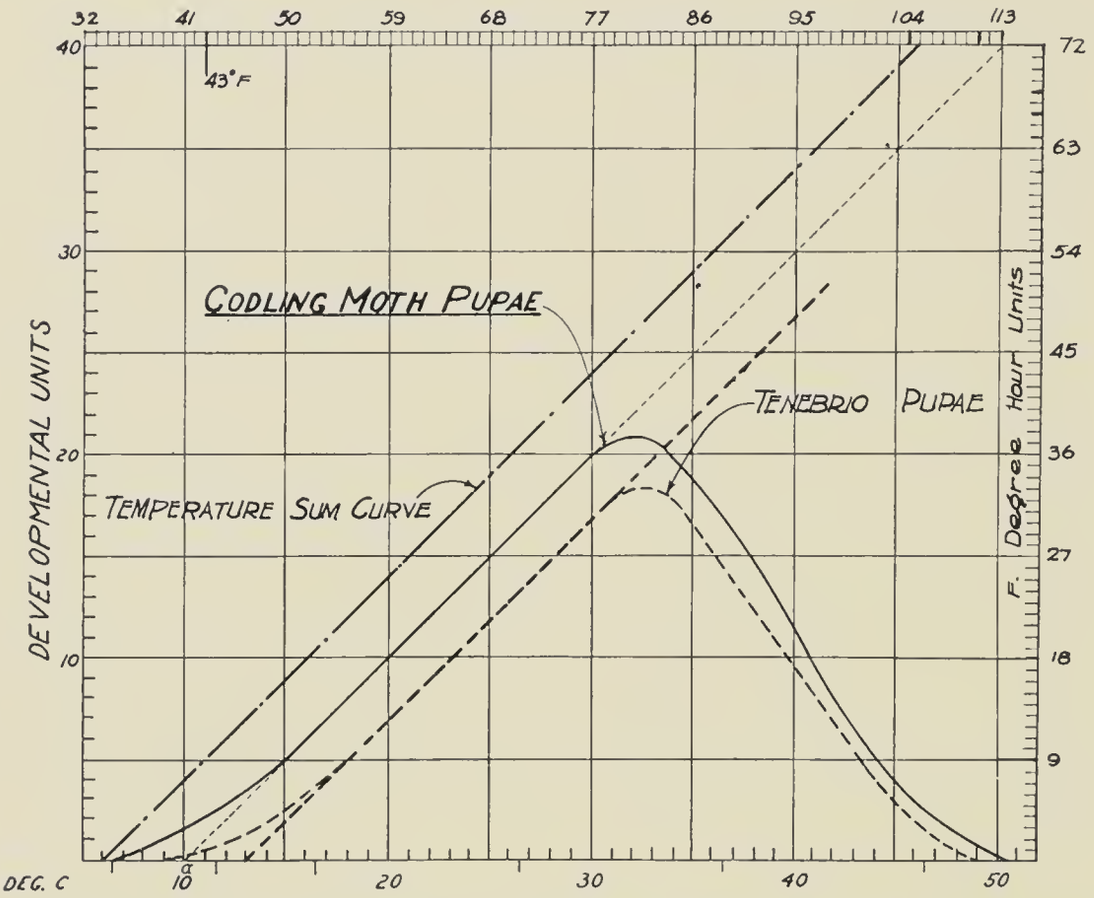


FIG. 31. Developmental curves: The dash-dot straight line is the rate of development curve assumed in summing temperature above 6° C. Compare with the curves of rate of development at different temperaturs for the pupae of the codling moth and the meal worm (*Tenebrio*) at the right. In connection with these two curves for insect pupae, an extension of the straight line portion is shown to indicate the failure of temperature summing. It will be noted that the straight line indicates a starting point marked *a* which is several degrees above the actual threshold, being at 10° for the codling moth and at 13° for the meal worm, while the actual threshold is three or four degrees lower. The velocity figures in Table II are read off on the scale at the left for each temperature on the horizontal scale.

without experimental or direct observational work on birds or mammals or plants, such as described by Kendeigh ('32).

Formulae for estimating daily means above a base, from the maxima and minima readings have long been in use, e. g. Strachey's 1887 formula (see Shelford '29, '30), but apparently were not utilized

by Merriam. It is well known that sums of temperature to be of biological significance must be based upon hourly or bihourly readings. The writer has further conducted extensive experiments showing that temperature sums are not a good index to rate of development or of other biological processes (Shelford '29), a fact originally pointed out by Krogh (1914).

2. Comparison of actual developmental rates and rates assumed in summing. The actual rates of development for the codling moth were determined in detail and checked against thousands of cases in nature. Figures 31 and 32 show the actual velocities of development as determined experimentally (codling moth, Shelford '25; meal worm,

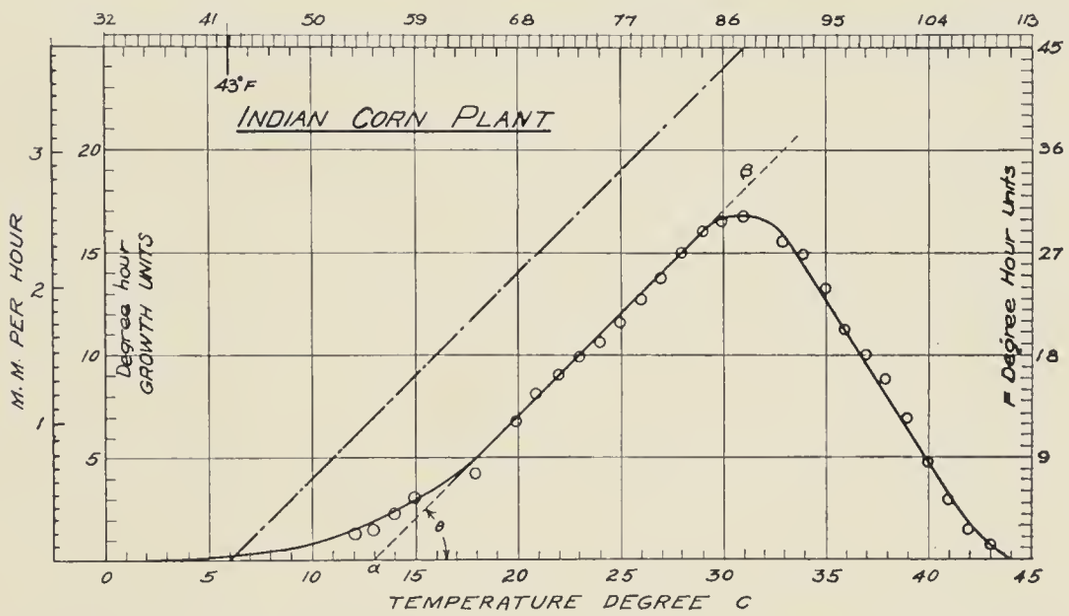


FIG. 32. The 6° summing curve in comparison with the actual rate of growth of the Indian corn plant, according to Lebenbauer (from Shelford '29).

Krogh '14, with extension to conform with the codling moth; Indian corn plant, Lebenbauer '14, and Livingston and Shreve '21). The units shown on the scale at the left equal the effect of one degree (C.) for one hour on all the curves. The straight lines (summation curves) are based on the assumption that the effect of one degree is the same at all temperatures.

The results of summing temperatures and developmental units (Table II) for two weeks, April 3-10 and August 28-September 4 (Fig. 33) are shown in Table III. In this table the sums made by the two-hour mean temperatures of figure 33 are divided by twelve to get the *degree days* and degree day developmental units of Table III.

Table II

Table showing the rate of development expressed as the effect of one degree for an hour (developmental units) in the straight line portions of the velocity curves in figures 31 and 32.

°C.	Meal Worm Pupa	°C.	Codling Moth Pupa	°C.	Indian Corn Plant
3	0	3	0	3	0.05
4	0	4	0	4	0.10
5	0	5	0	5	0.2
6	0	6	0	6	0.3
7	0	7	0.2	7	0.4
8	0	8	0.5	8	0.6
9	0	9	1.2	9	0.8
10	0.2	10	1.7	10	1.0
11	0.6	11	2.1	11	1.2
12	1.2	12	2.7	12	1.7
13	1.8	13	3.3	13	2.0
14	2.4	14	4.1	14	2.5
15	3.0	15	5.0	15	3.0
16	3.6	16	6.0	16	3.5
17	4.2	17	7.0	17	4.3
18	5.0	18	8 0	18	5.0
19	6.0	19	9.0	19	6.0
20	7.0	20	10.0	20	7.0
21	8.0	21	11.0	21	8 0
22	9.0	22	12.0	22	9.0
23	10.0	23	13.0	23	10.0
24	11 0	24	14.0	24	11.0
25	12.0	25	15.0	25	12.0
26	13.0	26	16.0	26	13.0
27	14.0	27	17.0	27	14.0
28	15.0	28	18 0	28	15.0
29	16.0	29	19 0	29	16.0
30	17.0	30	20.0	30	16.7
31	17.8	31	20.5	31	17.0
32	18.2	32	21.0	32	16.8
33	18.3	33	20.7	33	15.7
34	17.8	34	19.8	34	14.0
35	17.0	35	18.8	35	12.7
36	15.4	36	17.5	36	11.5
37	14.2	37	16.1	37	10.0

Table III

Table showing the application of the Merriam sums (sums above 0 with days at or below 6° C. omitted) of degree days, actual sums above 6° C., the progress of the meal worm pupa, of the codling moth pupa, and the growth of the Indian corn plant. Degree days may be compared with degree day developmental units in the case of the two insects.

	April 3 to April 10, 1916	July 28 to August 4, 1916
1. Sum of temperature (degree days) above 6° which are the assumed developmental units (See 3 and 4)	8.0	154.0
2. Merriam's sum	26.0	196.0
3. Degree day developmental units for the pupa of Tenebrio (See curve Fig. 31)	1.6	97.5
4. Degree day developmental units for the codling moth pupa	4.3	116.6
5. Growth of corn plant in mm	9.7	326.5
6. Assumed growth for 6° starting point (in mm.)	28.8	554.4
7. Assumed growth under Merriam's calculations (in mm.)	93.6	705.6

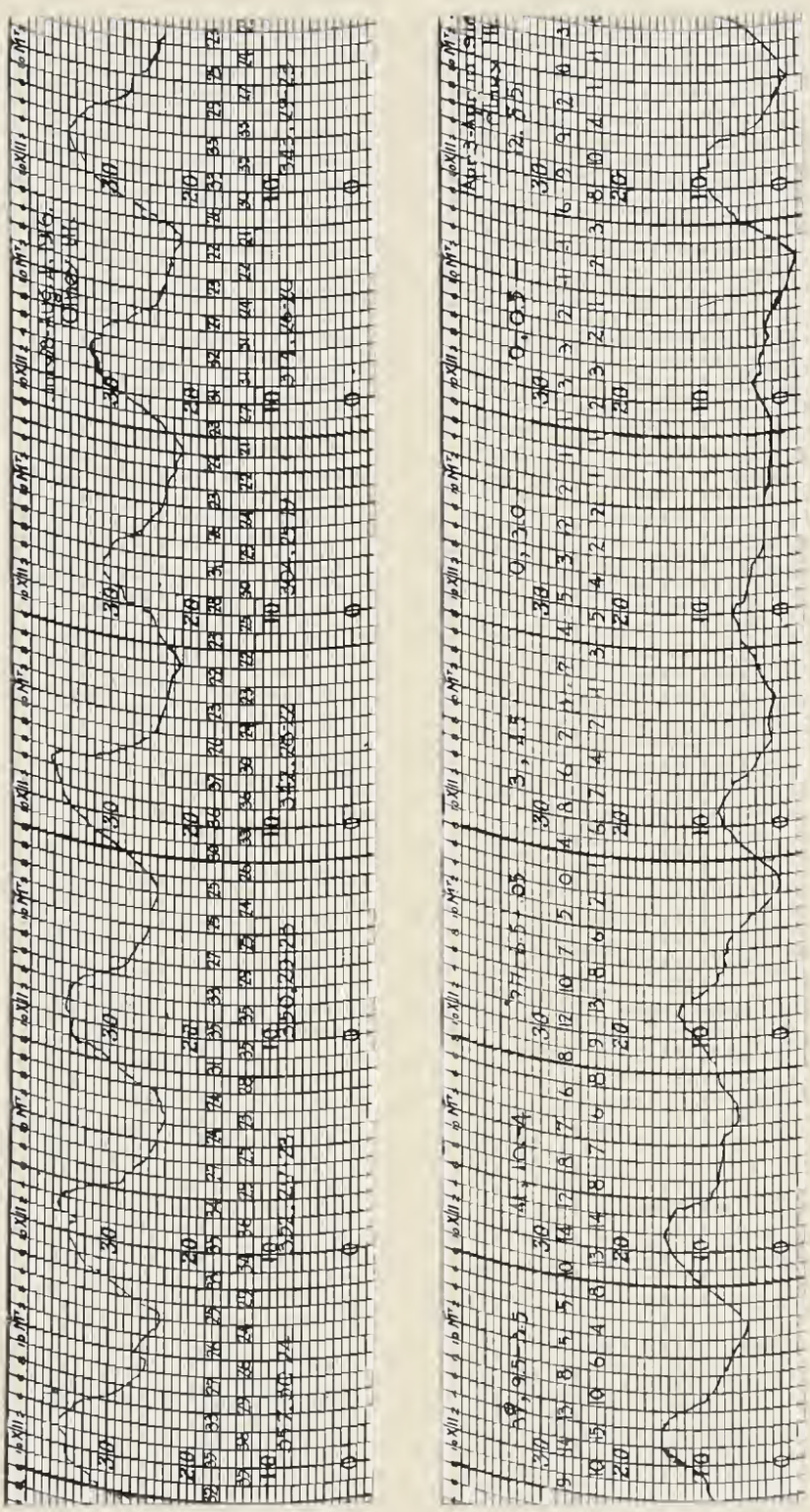


FIG. 33. A thermograph chart for a hot summer week is shown in the upper tracing of the figure. The mean temperature for each two hours is shown in the two-hour spaces. Below in the order named are the sums of two-hour means, the mean, and the mean less 6°. The lower tracing, for a cold week, shows the two-hour means, but the figures above are the sums of two-hour means less 6° for all two-hour periods in which the *mean* is more than 6°: this type of treatment is necessary in days in which there are two-hour periods with means below 6°. The mean daily temperature for this chart is derived as the mean of the maximum and minimum for the day, which is the method used in the U. S. Weather Bureau. The reader will find discrepancies between the mean temperature less 6° and the sum of two-hourly means less 6° divided by 12 to reduce to degree days. For example, on the last day the mean temperature is 5.5 but the sum of bihourly degrees is 12 and 1 degree day was accumulated though none was shown by the mean. In Merriam's accidentally erroneous summing the first three days would be included, but the last four days would not, because their means fall below 6°.

It will be seen from a study of the three rate curves that their form is radically different from the straight line assumption which rises at the same rate as the temperature rises. First the straight line type of curve does not begin until about one-fifth of the temperature range (compatible with growth) above the threshold or starting point has been covered. It then rises directly in proportion to the rise in temperature through about one-third the range compatible with life. The rate is rapidly retarded through the remainder of the life-compatible temperature range (less than one-half of the entire range). The 6° C. starting point is not far from the correct threshold temperature, but the rise in rate of growth or development does not begin to be proportional to the rise in temperature until 7° to 10° higher and ceases to be proportional at about 30° C. (86° F.). Figure 33 shows the bihourly average temperature for the week April 3-10, 1916, Olney, Illinois, and the week July 28-August 4, 1916, Olney, Illinois. For the warm week the sums of the two hourly means are shown for each day. The daily mean and daily mean above 6° C. are derived from the sum. For the cold week the sum of two hourly means *above* 6° C. are given, followed by the mean derived from the maximum and minimum and this mean less 6 degrees. There is considerable difference between this and one-twelfth the sum of two-hour means (see the fourth and seventh days).

The Tenebrio pupa requires 104 degree C. day units for completion and the codling moth 150 degree C. day units. The Merriam sum for the cold week is *fifteen* times as great as the actual progress of the Tenebrio pupa (compare items 2 and 3, Table III). Merriam's sum for the hot week is more than twice the actual progress. Comparing items 5 and 7, Merriam's assumed growth of the corn plant is nearly ten times the actual growth for the cold week and more than twice that for the hot week. The discrepancies due to the error in summing are large and those for the simple summing of temperatures are merely smaller. The sum-of-temperature assumptions are without scientific foundation and must be discarded.

3. Views of students of plants. Livingston and Shreve ('21) after a detailed analysis of climatic conditions (p. 528) in relations to plants, state: "From the preceding discussion, and from considerations presented in Part II, it appears that the system of life zones worked out by Merriam and now rather widely used in a descriptive way, especially by the United States Biological Survey, will require much modification before it may become at all satisfactory to a serious student of etiological plant geography. It is extremely unfortunate

that the actual data on which this system was originally based, and on which its applications are based in current descriptions, do not exist in the published literature. Neither Merriam nor any of his followers has thus far attempted to present the actual basis for the system in form such that a critical study of its good and bad features may be undertaken. Perhaps this may be a main reason why the whole subject of the climatic relations of floral and faunal areas has received so little attention at the hands of students who are able and willing to undertake the complex analyses which are involved in such a subject. The publication of the charts without the data on which they were based, together with the general and official adoption of the system by the United States Biological Survey, have given this important problem the appearance of having been satisfactorily solved —of being a closed subject. Those who have employed this zone system have either refrained from any discussion of its good and bad characteristics, or else they have merely taken the standpoint of advocates, and the lack of numerical data that are absolutely necessary for a critical study has tended strongly to discourage such inquiries. Also, a sort of authoritative atmosphere that seems to hang over government publications in general, together with the apparent authority and dogmatism that invariably go with well-printed (and especially colored) charts, to the exoteric reader, tend in the same direction, to retard real progress. Ecological students should realize that this is not by any means a closed subject, but that it is in a very early, formative stage, and that it requires vastly more critical and original study than has ever been accorded it."

Relations of the Zones to Communities and the Major Facts of Distribution

On his expedition to the San Francisco Mountain in 1889 Merriam discovered the altitudinal zonation of plant and animal communities in that region and named them primarily after the vegetation. He recognized the Alpine Zone, Timber-line Zone, Spruce or Hudsonian Zone, Balsam Fir or Canadian Zone, Yellow Pine Zone, Pinon Zone, and the Desert Zone.

Starting with the San Francisco Mountain and with belts that correspond to vegetation, Merriam carried his zones across the continent on the basis of his temperature theory, cutting the major communities crosswise from west to east. Lengthwise, or from north to south, on the great plains grassland area, the dominant grasses belonging to several genera are distributed throughout. These are divided into three zones. Likewise, the bison, pronghorn antelope, prairie

Fig. 34. Map of plant climaxes, modified from Weaver and Clement.

dog, kit fox, in fact, all the more important grassland animals, have their population divided between three zones, though constituting a part of our best known plant-animal formation (biome).

Where the great plant-animal communities are cut across by the life zones, *subclimax plants*, river margin shrubs, and *animals belonging to local conditions* have to be the main reliance as indicators. The trees and shrubs skirting the streams and animals such as the elk and grizzly bear which were found among them occasionally are used though their presence here is governed by soil and water and trees rather than climate. Again in a few cases biotically equivalent varieties of the same species may show relation to life zones. The zonal basis is, however, entirely a secondary matter. Similar violence is done the Deciduous Forest Community. The zones are quite generally out of accord with vegetation areas and natural communities over the southeastern third of North America. The Transition Zone, in particular, includes beech-maple forest, tall and short grassland, poplar parkland, chaparral, yellow pine forest, etc.

Disagreement of the major facts of distribution with the Merriam zones has been indicated by students both with taxonomic-faunistic viewpoint and with a quasi-ecological viewpoint.

Disagreement with the zones is indicated also for mollusca by Pilsbry and Ferriss ('06) in the following terms: "For the student of molluscan distribution, the life zones of the United States as mapped by Dr. Merriam emphasize the secondary and not the primary facts of distribution. The laws of temperature control, which he has developed with keen insight, do not define transcontinental zones of primary import zoologically. These zones are secondary divisions of vertical life areas of which the molluscan faunas were evolved in large part independently."

In his studies of the mammals of the Flathead Lake Region in Montana, Dice ('23B), after pointing out the correspondence of the faunas with those one to two hundred miles away, points out difficulties with life zones (p. 259) in the following terms:

"However, the correlation of these faunas with faunas of more distant regions offers greater difficulties, and little seems to be gained by trying to homologize the faunal area of the bunchgrass near Flathead Lake with the Alleghanian faunal area of the eastern United States in order to form a Transition life zone. The relationships of the lower coniferous forests near Flathead Lake to the Canadian fauna and those of the higher mountains to the Hudsonian fauna respectively of eastern North America are also somewhat remote."

Further, Dice ('23A) takes issue with the life zones in general with reference to the life zones of Alabama (Howell '21). On page 43 he states, "The life zones of Merriam are founded on the belief that there are zones of life extending transversely across the continent of North America, in the south as well as in the north. However, no species of mammal listed in this paper as characteristic of the Upper Austral Zone of Alabama is listed by Hall and Grinnell as characteristic of the corresponding zone in California." On page 47 he states, "The distribution of the species of mammals in the State of Alabama is not well shown by the life zone map presented. Only a relatively small percentage of the species known from the state agree closely in distribution with the boundaries of the life zones as mapped; and the presentation of such a life zone map gives an appearance of finality and precision to the classification of distribution which the facts do not justify.

"The recognition of transcontinental Upper Austral and Lower Austral Zones wrongly represents the faunal relationships of the parts of these zones mapped in Alabama and California respectively."

In the western mountains there is considerable agreement between the plant-animal communities and life zones. Grinnell ('14) has attempted to bring these two systems into harmony and has progressed a long way toward the modern ecological viewpoint, especially from the standpoint of biotic interaction. This would have been impracticable had he not been dealing with a mountain-dominated region, in which the life zones and biotic communities are quite generally in agreement.

As ordinarily presented in America, however, the two systems are so completely out of harmony as to viewpoint, that it is best to leave the life zones to the field of zoogeography, having for its aim the explanation of evolutionary phenomena, but with no ideas of modern community analysis or experimental work. The American life zone viewpoint has been carried so far in the United States Biological Survey that it has faced modern problems of biotic balance, relation to weather and other relations of agriculture, and grazing without suitable scientific foundation.

Modern ecology is concerned with the dynamics of communities. Their development in denuded or other new areas has occupied a large amount of attention and the final stage of this development is taken to stand out as the chief guide to such mappings as are shown in figure 31. Competition between *species*, both plant and animal, control of the habitat by organisms, fluctuations in abundance and their causes, are the chief interests of modern ecologists. Their work

has essentially little relation to the mere mapping of regions based upon a record of occurrence of genera, in which abundance, dominance, or influence of species in the community are matters of no concern. Such mapping comes into the field of ecology only when a consideration of the long historical development of the aggregations of species with changes in climate is sought.

European ecologists refer from time to time to North American life zones (Elton, '27, p. 11) as ecological regions. The Russian ecologists (Kashkarov '27, Filipjev '29B, and Kashkarov and Korovin '31) use life zones which correspond to the vegetation. Filipjev has mapped what is essentially the vegetation of Eurasia as *life zones*. The secondary and purely qualitative faunistic character of the life zones recognized in North America by mammalogists and ornithologists and their lack of agreement with natural ecological regions (communities) outside the western mountains has hitherto not been made clear to them.

BIBLIOGRAPHY

1928. Anthony, H. E. Field book of North American mammals.

1923A. Dice, Lee R. Life zones and mammalian distribution. Jour. Mammalogy, 4 (1):43.

1923B. Dice, Lee R. Mammal associations and habits of the Flathead Lake region, Montana. Ecol. 4 (3):259-260.

1929. Elton, Charles. Animal ecology. London.

1929A. Filipjev, I. N. The locust question in Soviet Russia. International Cong. of Ent.; 2:803-812.

1929B. Filipjev, I. N. Life-zones in Russia and their injurious insects. International Cong. of Ent., 2:813-820.

1914. Grinnell, Joseph. An account of the mammals and birds of the lower Colorado valley. Univ. of Calif. Pub. in Zool., 12:51-294.

1919. Hall, H. M. and J. Grinnell. Life zone indicators in California. Proc. Cal. Acad. Sci., 9:37-67.

1921. Howell, Arthur H. North American fauna. No. 45. U. S. Dept. Agri.

1927. Kashkarov, Daniel N. An ecological survey in the environments of the Lake Sary-Tshilek, North Ferghana. Title of abstract. (Jour. of the Middle Asiatic Committee on Museums and Protection of Historical Monuments of Art and Nature) Title of Journal in Russian.

1931. Kashkarov, Daniel N. and E. Korovin. Essay on the analysis of the ecological routes of the distribution of the flora and fauna in Middle Asia. Title of abstract. Jour. of Ecol. and Biocenol. 1:58-87.

1932. Kendeigh, S. Charles. A study of Merriam's temperature laws. Wilson Bulletin, 44:129-143.

1921. Livingston, Burton E. and Forrest Shreve. Distribution of vegetation in the United States. Publ. Carnegie Inst. of Wash. No. 284. Pp. 528-529.

1892. Merriam, C. Hart. The geographic distribution of life in North America. Smithsonian Rep. 1891:365-415.

1899. Merriam, C. Hart. Zone temperature. Science n. s. 9(212):116.

1906. Pilsbry, H. A. and J. H. Ferriss. Mollusca of the southwestern states. Proc. Acad. Nat. Sciences of Philadelphia. 58:123.

1929. Shelford, Victor E. Laboratory and field ecology. Baltimore.

1930. Shelford, Victor E. Phenology and one of its modern descendants. Quart. Rev. of Biol. 5:207-216.

1876. Wallace, Alfred R. The geographical distribution of animals.

University of Illinois.

Champaign, Illinois.

SNOW AND GOSS, THE PIONEERS IN KANSAS ORNITHOLOGY

BY MRS. H. J. TAYLOR

A rich full life expresses itself through ever inereasing avenues. It discovers the interrelation in all fields of knowledge and enters into them with eourage and enthusiasm attaining an ever widening horizon of human understanding. When the spirit of such a life is set free it sheds a radianee on many fields of learning and investigation, and each claims it as the exponent of a particular field.

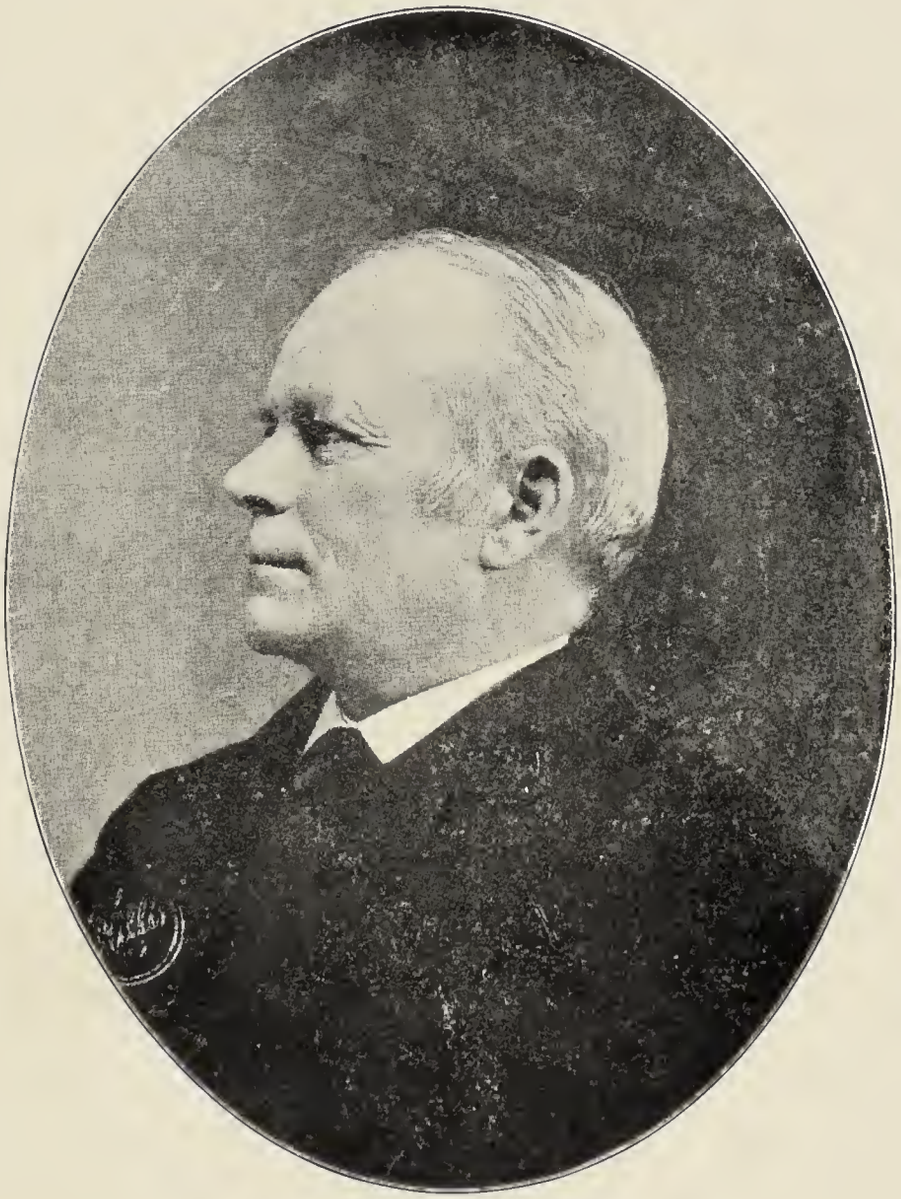
Francis Huntington Snow's was sueh a life. During his four eollege years he became a thorough student of the classics. A theologieal eourse at Andover Seminary increased his love for the classies and deepened his human insight. When he was ealled to Lawrenee, Kansas, where the State University was about to open its doors, he looked forward to teaching the language and literature of the classics. Snow understood and met the needs of the fifty-five enrolled students. He taught mathematics, geography, and the beginnings of natural science. His love for and knowledge of Latin and Greek made a rieh background but in the university of the world he became a geologist, a zoologist, a botanist, an entomologist, an ornithologist. This paper concerns itself primarily with F. H. Snow, the ornithologist.

Francis Huntington Snow was born in Fitchburg, Massachusetts, June 29, 1840. He dicd at Delaficld, Wisconsin, September 21, 1908. He was buried in Lawrence, Kansas.[1]

In 1862, at the age of twenty-two years, Snow was graduated from Williams College. He was appointed valedictorian by the faeulty, a singular honor among elassmates such as Frank Carter, who in 1881 became president of Williams College, Professor George Raymond, and Professor E. H. Griffin, who with others, have attained distinetion. The promise of Snow's young manhood was abundantly fulfilled in his sixty-eight years.

In Kansas the State University was coming into being. Its doors were to open in September, 1866. A call to oeeupy a chair in the new institution was, through the recommendation of Governor Charles Robinson, extendcd to F. H. Snow, and he beeame one of the thrce men eonstituting the first faculty of the University of Kansas. He remained aetive in this university until his death in 1908. He had served forty-two years. In 1881 Professor Snow received the degree of Ph. D. from Williams College, and that of LL. D. from Princeton in 1890. He was a member of the honorary societies of Sigma Xi and Phi Beta Kappa.

[1]From a letter received by me in September, 1931, from Professor Snow's daughter, Mrs. Martha Snow Brown.



Francis Huntington Snow, 1840-1908

A paper read by Doctor Snow before the Academy of Science at Topeka, January 2, 1903,[2] follows in part: "When the writer of this paper arrived in Lawrence, Kan., in the last week of August, 1866, about ten days before the opening of the State University, he took the earliest opportunity to call upon the chancellor of the University. He took it for granted that some preliminary arrangements would be necessary before the arrival of the important day which should usher into existence so important an institution as that with which he was to be connected as a member of its first faculty. The chancellor . . . informed him that nothing could be done until the opening day, and advised him to 'get a gun and go shooting'. This advice was conscientiously followed, with the result that the writer soon became deeply interested in the birds of Kansas, and began to prepare a catalogue. He had the entire field to himself, there being no other person in the state for several years who was known to him as having an interest in ornithology. He soon organized among his students an enthusiastic class in zoology, and instituted an ornithological survey. . . In . . . 1872, he published the first edition of his Catalogue of the Birds of Kansas, in the Kansas Educational Journal. The list of birds in this catalogue included 239 species and varieties, of which thirty-two species were inserted on the authority of Dr. T. M. Brewer, of Boston. . . I published no additional complete list of the birds of Kansas, having left the formal continuance of this work to my friend, Col. N. S. Goss, so long as he lived. Thus, all together, the author of this paper, during the last third of the nineteenth century, had catalogued 305 species and nine varieties of Kansas birds, or a total of 314 numbers or entries.

"Up to the year 1878 no other citizen of Kansas had published any facts regarding the birds of Kansas. In that year Col. N. S. Goss began his notes upon this subject in an article on the 'Breeding of the Duck Hawk in Trees.' . . . On July 25, 1879, he wrote me that he had in his collection 154 species of Kansas birds. . . . In the same year he made his first addition to the list of Kansas birds—Bonaparte's Gull. . . He continued to increase our knowledge of the bird fauna of Kansas until he had added thirty-one species and races to the list."

In 1881 Prof. Snow reported the capture of a "Snake-bird" in Kansas to Dr. Elliott Coues, who made it the subject of a note in the Bulletin of the Nuttall Ornithological Club.[4] Col. Goss, in his "His-

[2]Transactions of the Kansas Academy of Science, Vol. XVIII, p. 154.
[4]Bull. Nutt. Ornith. Club, 1882, Vol. VII, p. 61.

tory of the Birds of Kansas"[5] makes the following comments on this species:

"A rare summer visitant. . . This species was captured within the State, in the Solomon valley, in August, 1881, by Mr. C. W. Smith, of Stockton; and May 1st, 1888, Mr. Daniel Lambert, of Wilburn, Ford county, shot, in the northern part of Meade county, on Crooked Creek, five of the birds, out of a small flock that arrived a few days before and together. . . "

In 1913, C. D. Bunker published "The Birds of Kansas."[6] This report merely says of the Water-Turkey: "Catalogued as accidental by Doctor Snow. No Kansas collected specimen in the University Museum."

In the same paper the author says: "The study of Kansas birds, while not having been taken up by the government surveys, has been the subject of considerable work. Doctor Snow was the first scientist in the field. He began his study of Kansas birds upon his arrival at the University in 1866, and continued his interest until dis death. . ."

In his paper on "Relation of Birds to Horticulture,"[7] Professor Snow states the food habits of various species of birds and points out their value as insect eaters. Of the English Sparrow he says: ". . . a colony . . . has been securely established at Topeka. . . . I have often been asked my opinion as to the advisability of introducing the English Sparrow into Kansas as a protection against insects . . . authorities differ widely upon this question. . . . It is claimed by Dr. Coues . . . that 'there is no occasion for these birds in this country, and that the good they do in destroying certain insects has been over-rated.' Mr. Thomas Gentry, of Germantown, Pa., states that the sparrows . . . 'have become quite common in the surrounding country, and are driving away the robins [and] bluebirds . . . [the sparrows] have been of immense service in ridding our squares of the caterpillars, which were once so prevalent and so annoying. . .' Dr. Brewer says: 'We have the sparrows in great abundance in Boston, and for six years I have day after day, summer and winter, closely watched them. They never molest, attack or try to drive away any birds except their own species. . . . The bluebirds do molest and drive off the sparrows, and have been known to take possession of and keep boxes put up for and belonging to the sparrow.' Mr. Stephen Gould, of Newport, R. I., says: '. . . [the sparrow] seems to court the society of other birds, and never have the birds been so abundant on our place. . .' I may add

[5]History of the Birds of Kansas, 1891. By N. S. Goss. P. 37.
[6]Kan. Univ. Sci. Bull., Vol. VII, No. 5, June, 1913, pp. 137-158.
[7]Transactions of the Kansas State Horticultural Society, 1876, pp. 62-75.

that the report of the French parliament, based upon the most thorough scientific observations, places the English Sparrow at the head of the useful birds of France. . . . I cannot close this address without calling your attention to the great advantage which would be derived by the State if in our public schools instruction should be regularly given upon these practical subjects which are so closely related to our daily lives. Much of the time now spent by our children in the school room is wasted in the vain attempt to comprehend abstract principles of arithmetic and grammar, and in memorizing unimportant . . . details."

Professor Snow was the pioneer in Kansas ornithology. This work brought him recognition among scientific men. He attained in many fields of natural science. It was in the field of entomology that he attained not only national but international scientific recognition.

My own pioneer days on a Wisconsin farm were vividly recalled when I read of Professor Snow's efforts to save the wheat and corn fields of Kansas from the chinch-bug. We knew this pest in the '70's. Every child in the family knew and dreaded the sign of the chinch-bug. In well headed wheat fields stalks began to fall due to rust on the stem. It was the work of the chinch-bug.

Between the years 1885-1896 Professor Snow published seventeen papers on this destructive insect, four of these appearing in 1892. From a letter I received in September, 1931, from a former student of Snow I quote: "One of his more spectacular pieces of work was to destroy the chinch-bug which was taking heavy tribute from the farmers' crops. To accomplish this he found a fungus which was preying upon the bugs and proceeded to cultivate the fungus and to send it out to the farmers of stricken districts in small parcels, by mail, with instructions that they distribute the fungus where chinch-bugs were thickest. In this way he hoped that the parasite would spread and the bugs would be destroyed. For a number of years the state granted a special appropriation to carry on this work in a special laboratory in the University. Finally it was abandoned as ineffectual."

Although Professor Snow's experiment failed, it was nevertheless of far reaching and great value in awakening the farmers of the middle west to the thought that in scientific investigation lay the hope of controlling the pests of agriculture and horticulture. I recall my father saying that a professor in the Kansas University had the right idea when he studied practical things like chinch-bugs. I never knew the name of the professor until I began to write this paper.

From 1872-1907 Snow conducted twenty-six collecting expeditions mainly for insects. E. Miller says:[8] "At the present time the entomological collection contains over 21,000 species and 275,000 specimens of insects, the largest collection in the United States." L. L. Dyche, several times a member of Snow's expedition, says:[9] "In 1877 Professor Snow conducted an expedition to Wallace county, Kansas . . . the party collected about 1500 specimens of the then rare species of tiger-beetle, *Amblychyla cylindriformis*. In 1876, . . . these beetles were reported to have sold at from five to fifteen dollars for a single specimen. . ." Through exchanges with this beetle many specimens were added to the University Museum. Shortly after the death of Snow, by an act of the regents, the museum collection became The Francis Huntington Snow Entomological Collection.

Vernon L. Kellogg says:[10] "He [Snow] was the pioneer naturalist of Kansas, and for thirty years its most conspicuous representative in meteorology, botany, ornithology, and entomology. . . . His enthusiasm and energy were contagious. He made first-class men out of the best of us, and something at least worthwhile out of the worst of us. . ."

As student, teacher, friend, Snow left a deep impress. "I studied under Snow" will be a valued credential so long as an alumnus remains who can say it. Snow's college training was received from rare men. Among his teachers at Williams were Mark Hopkins and his brother Professor Albert Hopkins and that great spiritual force and interpreter of life, John Bascom. He also studied under Agassiz and came under the influence of David Starr Jordan. Men were drawn to Snow by his sincere and charming personality.

Not only to the University of Kansas but to the entire state did Francis Snow give great personal service. He was one of seventeen men to organize the Academy of Science in 1868. Five times was he elected its president. In 1885 the legislature named in his honor Snow Hall of Natural History. At the dedication Professor Snow was carried to and from the building on the shoulders of students.

J. W. Green, student of Professor Snow, says:[11] "At his home or at the home of his friend, the instructor and toiler disappeared, and we came into contact with a most genial, lovable, and companionable man. As husband, father, friend, gentleman, and scholar, his life was

[8]Kan. Acad. Sci., Vol. XXII, p. 24, 1908.
[9]Ibid., p. 24.
[10]Journal Economic Ent., Vol. 2, p. 84.
[11]Graduate Mag. Univ. Kan., Vol. VII, January, 1909, p. 128.

not only above reproach, but in him, sweetness of disposition, gentleness of manner, and consideration for others were mingled with perfect integrity."

Unspoken expression may reveal depth of feeling more fully than words. In writing Professor Snow's obituary, Vernon Kellogg says in conclusion:[12] "My personals feelings I have given no rein at all. As student, assistant, colleague and intimate friend of Francis H. Snow for twenty-five years, I have in my mind and heart sueh a wealth of dear memory that I do not trust myself even a word or phrase of personal appreeiation. If I should, it would be too extravagant for publicity, too insufficient for my own satisfaction."

An alumnus is proud of his alma mater. Sueh as Francis Huntington Snow make alma mater proud of the alumnus. Snow's serviees made the University of Kansas and the State his debtor. His spirit has enriehed the world.

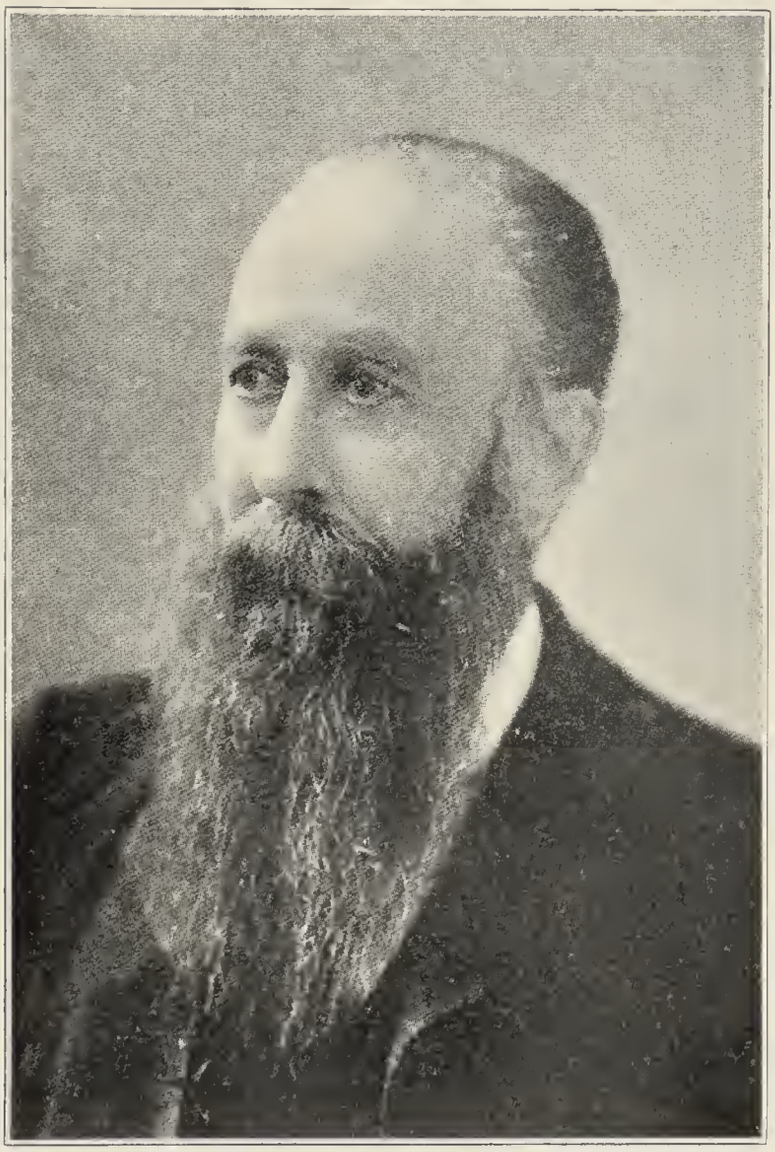
* * * *

The names of F. H. Snow and N. S. Goss are linked as pioneers in Kansas ornithology. Goss died over forty years ago. The data on his life contained in this paper are largely from files of the Topeka State Journal, issues of Mareh 10 and 12, 1891, and a "Sketeh of Goss" by Mary Jackson of which the Topeka Journal says: It is "the only authorized and authentic biography of Colonel N. S. Goss".

Nathaniel Stickney Goss, the ornithologist and naturalist, was born of Puritan stock in Lancaster, New Hampshire, June 8, 1826. He died at Neosho Falls, Kansas, March 10, 1891. He was buried in Topeka Cemetery in Kansas.

Goss was but a youth when his father lost his property and the family came west and settled in Pewaukee, Wisconsin. Here he attended the district school and the loeal aeademy. In 1854, at the age of twenty-eight years, he married Miss Emma F. Brown, of Pewaukee. Two years later he moved to Waverly, Iowa, with a view to entering the banking business. While he was making arrangements for his location, his bride of only two years died. Overcome by this loss he left Iowa in the spring of 1857. With horse and buggy he traveled to Kansas, a reeently made territory, and settled on the Neosho river where now stands the city of Neosho Falls. When the little settlement was laid out for a town site Goss beeame its first postmaster. In 1858 a grist mill was established and he sold flour and meal to the Indians, receiving in payment Indian ponies, buffalo robes, and money.

[12]Journal Economic Ent., Vol. 2, 1909, pp. 83-85.



Nathaniel Stickney Goss, 1826-1891

Goss had taken a keen interest in the development of this new territory. He was the leader in public affairs. In 1860 he was elected and commissioned major. In 1863 he was made lieutenant-colonel of the Sixteenth Kansas Militia Cavalry. In 1867 he was appointed register of the land office at Humbolt. Two years later he resigned to become attorney for the Missouri, Kansas, and Texas Railway with headquarters at Neosho Falls. Through his efforts the road was put through Neosho Valley. In 1866 the stockholders elected him president. He was called the "Father of Neosho Valley".

The valley of the Neosho River was familiar ground to Goss. Along its banks and over the Kansas prairie he had walked noting the bird life and collecting specimens. From early childhood the deep interest of his life lay in roaming fields and forests to study life in its natural surroundings. When he had made a comfortable fortune he devoted most of his time to the study of birds and the preparation of bird skins. He traveled widely to know birds. From the Everglades of Florida he followed the western coast line to the Gulf of California. He visited the Rockies and the Sierra Nevadas. The fruit of his labors gave a marvelous collection to the State of Kansas. In the fall of 1881 he took up his residence in Topeka. In this same year he donated his entire collection to the state upon the condition that it be known as "The Goss Ornithological Collection" and that he be the custodian during his life time. The offer was accepted. The legislature set apart a room for the collection and also one for Goss's own use.*

In 1883 he published a catalogue of the birds of Kansas, based upon observations in the field and knowledge gathered during a residence of over twenty-six years in Kansas. The catalogue embraced forty-nine families and 320 species and subspecies. In 1886 he revised the catalogue, increasing the species to 335.

The American Ornithologists' Union was established in New York in 1883. "At the first congress forty-seven ornithologists were elected to active membership."[13] Colonel Goss was one of the original forty-

*The following information concerning the present condition of the Goss Collection is taken from a letter written by Mr. Kirke Mechem, Secretary of the Kansas State Historical Society, at Topeka, April 15, 1932:

"The Goss collection of birds is now housed in the museum of the Kansas State Historical Society on the fourth floor of the Memorial Building. It has been there since 1914. It is in very good condition although the birds at present need a thorough cleaning.

"The collection comprises 1523 birds of 756 species. The collection is unique in that each species of birds is mated. I understand that Col. Goss sometimes had to wait several years before he could mate some of these birds. There have been no additions to the collection since it was given to the Society."

seven members. This honor came to him unsought and without his knowledge. "Since the organization of the A. O. U. Colonel Goss has never failed to attend its meetings. . . . At the last meeting when the place of the next Congress was under discussion . . . he said . . . 'wherever it is held, Colonel Goss will be there if he is alive.' "[14]

The one ambition of his life was the completion and publication of the "History of the Birds of Kansas." This book came from the press a few days before his death. It was the summing up and completion of his life. "As a hand book or manual of the birds of a definite area, Colonel Goss's 'History of the Birds of Kansas' might in many ways serve as a model to future writers of similar works. As its title indicates, the work is strictly limited to the birds known to occur within the State of Kansas, which now number 343 species and subspecies . . . the plates are a novel feature, and, as an inexpensive method of illustration, may be regarded as a success, quite excelling in effectiveness any previous attempt at photo-engraving in ornithology we have seen. In fact, the plates are little less than a revelation respecting the possibilities of photogravure as an aid in ornithological illustration. The figures are all from mounted specimens in the 'Goss Ornithological Collection' . . ."[15]

In the preface to his "History of the Birds of Kansas", Colonel Goss says: ". . . It embraces 343 species and subspecies. . . . The photogravure illustrations represent 529 mounted birds (my own work) in 'The Goss Ornithological Collection.' The characteristic descriptions of the different orders, families, genera, species and races are chiefly from 'North American Land and Water Birds,' by Baird, Brewer and Ridgway . . . I have also quoted freely from Mr. Ridgway's 'Manual' and 'Birds of Illinois,' and occasionally from Dr. Elliott Coues' 'Key to North American Birds.' "

Goss's "History of the Birds of Kansas" is pleasant as well as instructive reading. He says of the Whistling Swan: "I have one in the 'Goss Ornithological Collection,' shot March 12th, 1875, in the Neosho valley. . . . In olden times, when credulity largely prevailed among the people, the most fabulous and absurd stories were readily believed. The Swans were supposed to sing sweetly, especially when dying. This belief seems to have been based upon the fable, that the soul of Orpheus was transmigrated into a Swan, and for this reason these birds were held in veneration. The Greek and Latin poets

[13]Bird-Lore, Vol. I, 1899, p. 147.
[14]Auk, Vol. VIII, 1891, p. 246.
[15]Auk, Vol. VIII, 1891, pp. 228-229.

praised its song, and the philosophers and historians recorded it as a fact. I quote from three of the most noted. Socrates says: 'When Swans perceive approaching death, they sing more merrily than before, because of the joy they have in going to the God they serve.' Aristotle says: 'Swans are wont to sing, particularly when about to die.' And Cicero says of Lucius Crassus, that 'He spake with the divine voice of a Swan about to die.' Pliny, one of the first to doubt, says: 'Some affirm that Swans sing lamentably a little before death, but untruly, I suppose, for experience in many has shown the contrary.'" (Page 106-107.)

Colonel Goss's friends were unnumbered, a few were intimate. Not many days after the death of General Sherman, in 1879, Colonel Goss said to Judge Humphrey: "All I wish when I am dead is that some friend will stand beside my grave and say that I have led an honest life, and have not been without good deeds or lasting friendships, for no man of whom that can be said in truth has lived in vain." The Judge replied: "I love you as a brother, and you have been my true kind friend, and if I should survive you I shall . . . say that you have not only not lived in vain but the world has been better for your existence."

Colonel Goss was not a churchman. He believed in the religion of humanity and never let an opportunity pass to do a kind act or help a fellow being in distress. When the "History of the Birds of Kansas" came from the press Goss said to Judge Humphrey: "I wish that book to be my monument. I care nothing for a shaft of stone to mark my resting place, I want to leave my monument to humanity. My work is now ended and hereafter I will play."

Colonel Goss was in splendid spirit when his book came from the press, and he went to Neosho Falls to spend a few days with his nephew, C. W. Waterman. A few days later, on the morning of March 10, 1891, the governor's office in Topeka received a dispatch from C. W. Waterman of Neosho Falls. It stated that Colonel Goss was stricken down, presumably with heart disease, while walking along the street.

After passing resolutions on the death of Colonel Goss the legislature adjourned. Upon its arrival, the body was taken directly to the senate chamber where it was placed in state in front of the president's desk. Upon the casket, surrounded by a wealth of flowers, was placed the "History of the Birds of Kansas". The room containing The Goss Ornithological Collection, as well as Colonel Goss's private room, was draped in mourning. The State House was closed on the

day of the funeral. At the service Dr. F. H. Snow, then Chancellor of the University of Kansas, spoke eloquently upon the life of Colonel Goss and the heritage he left to the state.

When Colonel Goss took up his residence in Topeka in 1881 he bought a lot in the Topeka Cemetery. The remains of his wife, which for twenty-five years had rested in Pewaukee, Wisconsin, he had had reinterred in Topeka with the expressed wish that he be laid by her side.

On March 12, 1891, the remains of Nathaniel Stickney Goss were laid to rest in the Topeka Cemetery beside those of the companion he had lost long since and loved the while.

The following paragraphs, taken from the Topeka State Journal for March 12, 1891, are self-explanatory, and are probably of sufficient interest to justify reproducing in full:

"A special from Atchison to the 'Globe-Democrat' says: Ex-State superintendent of insurance, R. B. Morris, of this city, who was a close personal friend of the late Col. N. S. Goss, of Topeka, relates an interesting circumstance of that gentleman's life in connection with the gift of his ornithological collection to the state.

"When Col. Goss gave the state the collection, he exacted a condition that the state should provide a suitable room in which to keep the collection and also a room for his own private use. This the state faithfully complied with. Soon after making the gift, Col. Goss, who was a wealthy man, made a will in which he bequeathed a large sum of money for the maintenance and increase of the collection.

"Unfortunately this was afterward changed and the item of maintenance cut out. It came about in this way: A little more than a year ago Secretary of State Higgins gave an old soldier a lunch-stand privilege in the main hall of the State House. The old soldier set up his stand in close proximity to the ornithological room, and the crowds that daily visited the collection were always loaded with edibles.

"This offended Col. Goss, and he protested against the presence of the lunch-stand, but Mr. Higgins refused to yield and the old soldier held possession. Col. Goss, who took great pride in the collection, regarded the act of Mr. Higgins as a lack of appreciation of the gift, and he at once had his friend, Railroad Commissioner Humphrey, prepare a new will omitting the bequest to the state.

"Had he not given his word that the ornithological collection should become the property of the state, this, too, would have been withdrawn. The story as here told was received by Mr. Morris from Col. Goss himself."

And at another place in the same issue occurs the following version:

"It is stated that Colonel Goss a few weeks since added a codicil to his will, in which he willed his library and a large collection of relics and curios which he had gathered on his trips to various sections, to the state university, and that he changed the provision which he had previously made, giving the state a large sum of money for the maintenance of the 'Goss Ornithological Collection', willing the amount to his nephew, C. W. Waterman, of Neosho Falls.

"He made the latter change, it is said, because the secretary of state allowed a cigar stand to be maintained in the hall of the east wing of the capitol. Colonel Goss detested tobacco and was much perturbed when the cigar stand was established there by the guide. He protested against it, and his wishes not being complied with, he considered it a personal affront."

Berkeley, California.

NOTES FROM CENTRAL IOWA

BY PHILIP A. DUMONT

So very little has been published concerning late spring migration in central Iowa that some observations made in Polk, Dallas, Greene, Boone, and Hamilton Counties, from June 4 to 14, 1928, and from May 26 to June 21, 1929, are here submitted. Several of the field trips were taken with Mr. Arthur T. Watson and Mr. Kenneth R. Nelson of Des Moines. Mr. Walter Rosene of Ogden, and Mrs. John E. Stewart and Miss Olivia McCabe of Des Moines, were each on at least one trip with us.

In 1928 migration continued much later than usual, as is indicated by the number of birds seen on a field trip which Watson, Nelson, and I took on June 6 in Dallas, Boone, and Polk Counties. One hundred and ten species of birds were observed, including eleven species of shore birds. Of the fourteen kinds of shore birds seen during the eleven days of 1928 in Iowa, at least nine were recorded on a later date than any given for the state by Bent (Bull. U. S. Nat. Mus., 142, 1927; and 146, 1929).

On June 3, 1929, Watson, Nelson, and I spent over eighteen hours on a field trip in Dallas, Boone, and Polk Counties, and secured a list totaling 115 species. While only two species of transient shore birds were seen on this trip, during the first week of June in 1928, nine species were seen by us in the same region. Another trip taken on June 6, 1929, entirely within Polk County, resulted in a total of 101, including seven species not seen on June 3.

The summer of 1929 was characterized by an influx of Mockingbirds, by several breeding records of the Cedar Waxwing, and by the utter lack of migrating shore birds.

The List

Holboell's Grebe. *Colymbus grisegena holboelli.* A flock of six birds carefully observed at Long Pond, seven miles west of Perry, Dallas County, on June 6, 1928. A male observed at Brenton's Slough, four miles west of Camp Dodge, Polk County, June 6, 1929. The recording of this species on such late dates is, of course, unusual. A more detailed account will be found in the September, 1929, number of the Wilson Bulletin, pp. 191-192.

Horned Grebe. *Colymbus auritus.* An adult in breeding plumage was on Little Wall Lake, three miles south of Jewell, Hamilton County, June 11, 1928.

Gadwall. *Chaulelasmus streperus.* On May 30, 1929, while at Little Wall Lake, Hamilton County, I had the unique experience of catching a Gadwall in my hands. I took it back to Des Moines with me for observation. Unfortunately it died the next morning. Evidently the bird was molting into the "eclipse" plumage, as the old primaries were quite worn and some of the new ones were already well advanced. This molting, no doubt, caused the bird's sickness and the resulting indifference to capture. In making up the skin no sign of injury could be found. The stomach was about half filled with pieces of pond-weeds and some form of small crustaceans. The specimen, a male, is now in Mr. Nelson's collection. Another bird was seen at Long Pond on June 3, 1929.

American Pintail. *Dafila acuta tzitzihoa.* Members of the Des Moines Audubon Society reported a male Pintail on a small pond at East 14th Street and Euclid Avenue, Des Moines, Polk County. The bird was present all through May and was seen by the writer on June 4, 1928.

Canvas-back. *Nyroca valisineria.* A pair at Little Wall Lake on June 11, 1928, and the male was seen again on the following day.

Ruddy Duck. *Erismatura jamaicensis rubida.* One female seen in a marsh east of Jewell on May 30, 1929; one at Long Pond, June 3, 1929; and one at Brenton's Slough on June 12, 1929.

Hooded Merganser. *Lophodytes cucullatus.* Two females were observed at Little Wall Lake, five miles south of Jewell, Hamilton County, May 30, 1929; one female seen with a flock of Blue-winged Teal, Mallard, a Gadwall and a Ruddy Duck on Long Pond, June 3, 1929. Because of the rareness of this species as a breeder in Iowa, it is quite probable that these were late migrants. A pair of these birds were found by Miss Olivia McCabe on a small pool of water in Des Moines, June 21, 1923. This pool, surrounded by willows and cat-tails, was within fifty yards of one of the principal avenues in the city. Because of the late date and of the fact that this was apparently a mated pair, they were reported as breeding, although I am not aware that the nest was found.

American Merganser. *Mergus merganser americanus.* A single female (not a cripple), seen on a small pond four miles north of Ogden, June 13, 1929. The latest spring departure date for this species recorded in Anderson's "Birds of Iowa" is May 16, in Winneshiek County.

Anatidae. An analysis of the ducks found in central Iowa in June, 1929, is as follows: Common Mallard, common breeder; Gadwall, late migrant; American Pintail, a pair on June 3, and a female on June 6, probably breeding, no nests found; Blue-winged Teal, most common breeder; Shoveller, two males on June 3, and one male on June 6, probably breeding, no nests found; Lesser Scaup Duck, two on June 6, three males and one female on June 12, probably either late migrants or non-breeding birds; Ruddy Duck, late migrant; Hooded Merganser, probably late migrant; American Merganser, late migrant.

Broad-winged Hawk. *Buteo platypterus platypterus.* The status of this species in Polk County has been given intensive study by several members of the Des Moines Audubon Society. A pair nesting in Crocker Woods, along the Des Moines River, have been found to be permanent residents. These birds were reported in the Bird Lore Christmas Census for 1927 and 1928. Mr. Watson has found them present during each month for two years and he furnished the data on the 1928 nesting recorded by me in the "Birds of Polk County, Iowa". About September, 1928, the female of the pair mentioned in the above account was noticed to have half of a third primary broken off and this conspicuous field mark served as a definite check on the bird's activities all winter, and until it molted the next summer.

Ferruginous Rough-leg. *Buteo regalis.* A pair of these hawks was seen at Brenton's Slough, west of Camp Dodge, on May 5, 1929, by Mr. and Mrs. John E. Stewart of Des Moines, and positively identified by us on June 6, 1929. Because of the similarity of this region to the rolling hills of western Nebraska we thought there might be a possibility of their breeding. But a search of the few trees along the stream disclosed no nest. Neither were the birds seen after that date. (See also Bull. Iowa Orn. Union, vii, 1929).

Duck Hawk. *Falco peregrinus anatum.* An immature female at Camp Mitigwa, five miles north of Woodward, Boone County, on June 6, 1928.

Ruddy Turnstone. *Arenaria interpres morinella.* A male in breeding plumage was seen at Little Wall Lake, June 11, 1928. I know of only one other occurrence of this species in central Iowa and that is of an unpublished observation by Arthur T. Watson of a single bird seen on June 5, 1926, flying up the Des Moines River near Camp Douglas, about six miles northwest of Des Moines.

Upland Plover. *Bartramia longicauda.* One juvenal, at least two weeks old, was caught to be photographed at Paton, Greene County, June 12, 1928.

Eastern Solitary Sandpiper. *Tringa solitaria solitaria.* A single bird observed at Fisher's Lake, twelve miles north of Des Moines, on June 3, 1928. Undoubtedly this was a late north-bound migrant.

Lesser Yellow-legs. *Totanus flavipes.* At Long Pond, June 6, 1928, a single bird crippled in one leg, and two birds there on June 12.

Pectoral Sandpiper. *Pisobia melanotos.* One at Little Wall Lake, June 12, 1928. Apparently a normal bird and uninjured.

White-rumped Sandpiper. *Pisobia fuscicollis.* In 1928 a flock of fifteen at Long Pond on June 6; seven at Little Wall Lake on June 11; and ten at Long Pond on June 12.

Baird's Sandpiper. *Pisobia bairdi.* Six at Long Pond on June 6, 1928, one at Little Wall Lake on June 11, 1928, and one at Long Pond on June 12. This is a later spring migration date than has been recorded by Bent for this species in the United States.

Least Sandpiper. *Pisobia minutilla.* Two at Long Pond, June 6, 1929.

Red-backed Sandpiper. *Pelidna alpina sakhalina.* Observed on both trips to Long Pond in 1928. Three on June 6 and two on June 12.

Semipalmated Sandpiper. *Ereunetes pusillus.* In 1928 one was seen at Brenton's Slough four miles west of Camp Dodge, Polk County, on June 5; ten at Long Pond, June 6; and three at the same place on June 12. Two of the three had injured legs.

Sanderling. *Crocethia alba.* A single bird still in the gray winter plumage at Long Pond on June 6, 1928. This species is also a straggler through the central part of the state.

Bonaparte's Gull. *Larus philadelphia.* A single bird was observed at Long Pond on June 6, 1928. Although found along the larger rivers and lakes of the state, it is not common at any time in the interior.

Least Tern. *Sterna antillarum antillarum.* A single bird noted flying over a small pond at East 14th Street and Euclid Avenue, Des Moines, May 27, 1929. The only Polk County record prior to 1929 for this species was of two birds seen by Kenneth R. Nelson, June 16, 1922, on the Des Moines River.

Black Tern. *Chlidonias nigra surinamensis.* Although formerly a common breeder in central Iowa, this species has been crowded out

in late years by lack of suitable nesting areas—the result of draining the marshes and small ponds. Numbers of these birds were seen in June, 1928, and a flock of thirty-five was seen June 13, 1929, north of Ogden, Boone County. However, no nests were discovered at Long Pond, a likely breeding place, seven miles west of Perry, Dallas County.

Yellow-billed Cuckoo. *Coccyzus americanus americanus.*

Black-billed Cuckoo. *Coccyzus erythropthalmus.* The summer of 1929 witnessed the periodic appearance of the "17-year locust" or Periodical Cicada (*Magicicada septendecim*) in tremendous numbers, at least in central Iowa. Concurrently, large numbers of both Yellow and Black-billed Cuckoos appeared, and were found feeding on these pupae. Besides the cuckoos, the Rose-breasted Grosbeak was the only other species noted feeding on the cicada.

Western Burrowing Owl. *Speotyto cunicularia hypugaea.* On May 9, 1928, a farmer living two miles northwest of Paton, Greene County, called Mr. E. W. Sells, of the same town, to report that four long-legged birds were staying around a ground hog hole in one of his fields. Mr. Sells visited the field on May 12, and saw two of the birds which he identified as Western Burrowing Owls. In writing to Mr. Walter M. Rosene, of Ogden, Mr. Sells gave him all the information and urged him to make a trip to Paton to confirm the identification. June 12, Robert Walker, Walter Rosene, Kenneth Nelson, and the writer accompanied by Mr. Sells, visited the same place and found one Western Burrowing Owl. The second bird undoubtedly was on the nest at that time as both were seen again on June 26, when Mr. Rosene spent the afternoon trying to photograph them. He succeeded in obtaining one picture. Mr. Sells saw six owls together later in the summer and concluded that four young grew to maturity. They were seen in the field until the latter part of October.

We secured about forty pellets on June 12 and several were examined by the late W. DeW. Miller, of the American Museum of Natural History, New York. These showed a large percentage of rodents while others found by Mr. Sells later in the summer consisted largely of beetles.

Dr. B. H. Bailey (Raptorial Birds of Iowa, 1918, pp. 231-233), records the Western Burrowing Owl from eight counties within the state. In five of these counties (Lyon, Sioux, Plymouth, Woodbury, and Sac), it has been reported as breeding, and in the other three (Dickinson, Kossuth, and Linn) its occurrence is only casual. Mr.

G. H. Berry's observations of this owl, made in the vicinity of Hawarden, Sioux County, and Lincoln County, South Dakota, are recorded by Anderson in his "Birds of Iowa". This record of Berry's is cited by Dr. Bailey but incorrectly credited to Linn County.

Therefore the nesting of the pair in Greene County is an extension south and east of the known breeding range of this owl.

Acadian Flycatcher. *Empidonax virescens.* In 1929 a mated pair was seen near Camp Mitigwa, five miles north of Woodward, Boone County, June 3; a nest containing four eggs was found by Messrs. Nelson and Watson in Crocker Woods, Des Moines, June 7. The nest, a loose structure made of plant-fiber and grass, was hanging in the drooping branch of a locust tree, three and a half feet above the ground. The eggs were hatched by June 20.

Olive-sided Flycatcher. *Nuttallornis mesoleucus.* A late migrant noted on June 10, 1928, along the Raccoon River southwest of Des Moines. The whitish tufts of feathers on either side of the rump and extending on the flanks under the wings were quite conspicuous in this individual.

Tyrannidae. A summary of the members of this family found in Central Iowa in June, 1929, is as follows: Eastern Kingbird, common breeder; Northern Crested Flycatcher, common breeder; Eastern Phoebe, common breeder; Acadian Flycatcher, uncommon breeder; Alder Flycatcher, rather common breeder—several nests at Des Moines; Least Flycatcher, uncommon breeder; Eastern Wood Pewee, common breeder; and Olive-sided Flycatcher, very late migrant, uncommon—one seen south of Valley Junction, June 6. The Yellow-bellied Flycatcher is a fairly common migrant in May, and the Arkansas Kingbird is a rare migrant, at least through Polk County.

Northern Cliff Swallow. *Petrochelidon albifrons albifrons.* One nest found by A. T. Watson, in a culvert northeast of Des Moines on June 1, 1929. Mr. Nelson and I found two pairs nesting near Moran, Dallas County, June 12, 1929. The nests were under the eaves of a corn-crib.

House Wren. *Troglodytes aedon* subsp. A male, collected at Des Moines, June 20, 1929, when compared with a series of subspecies *aedon* and *parkmani* in the American Museum of Natural History appeared to be intermediate. These intermediates are more common in central and eastern Iowa than the typical *parkmani*, and according to Mr. John T. Zimmer, a few of them have been collected in Nebraska.

Eastern Mockingbird. *Mimus polyglottos polyglottos.* One bird observed by A. T. Watson and K. R. Nelson one mile north of Polk City, Polk County, June 3, 1929. Mr. and Mrs. W. A. Kinnaird of Valley Junction reported a pair of these birds six miles south of that city on June 4, 1929. Watson, Nelson, and I saw this pair on June 6 and found their nest, which contained two eggs. Later Mr. Kinnaird reported that the nest had four eggs, all of which hatched. Another pair of mockingbirds was reported by Mr. Sibley H. Crosby in northeast Des Moines, June 7, 1929. A pair of these birds was seen by Mr. Paul Sandahl at the City Nursery in East Des Moines, June 10, 1929. Mrs. Stewart and I saw the male on June 20, but could not find the female. We believed she must be on a nest, but none could be found. Mr. Sandahl reported that they were last seen on June 26, 1929.

Willow Thrush. *Hylocichla fuscescens salicicola.* One seen in Des Moines, May 27, 1929. R. M. Anderson places this subspecies in the hypothetical list of his "Birds of Iowa", (1907). The range given for this bird in the A. O. U. Check-List is the following: "Breeds in lower Canadian and Transition zones . . . south to . . . central Iowa; . . ." Harry C. Oberholser, in a letter to me, June 15, 1929, says concerning the status of this bird in Iowa, "both might occur, get specimens; *salicicola* probably the common form. Otto Widmann (Birds of Missouri, 1907, p. 261), says of the two races in Missouri, "that both forms occur is certain . . . others (*salicicola*) have been taken in eastern as well as western Iowa . . ." It seems to me that this subspecies should have been included in Anderson's list.

Cedar Waxwing. *Bombycilla cedrorum.* While at the Ledges State Park on June 10, 1929, the Custodian, Mr. Carl Fritz Henning, informed me that a pair of Cedar Waxwings was building in a cedar in his yard. On June 16, 1929, I noticed a pair building near the top of a mulberry tree at my home in Des Moines. The nest was about twenty-eight feet from the ground and some of the material used in its construction was taken from an abandoned Robin's nest near by. A great deal of string and strips of bark were used, and building was done only in the morning. In the afternoon the pair either fed on mulberries or perched side by side close to the nest. After coming to Des Moines to attempt a photograph of this nest, Mr. Rosene found, upon returning to his home, that there was a waxwing's nest within 150 feet of his own house.

Starling. *Sturnus vulgaris vulgaris.* A pair seen in Des Moines, March 21, 1929, by Mr. and Mrs. Alexander W. Lee. This is the first

appearance of the Starling in central Iowa. (See the Wilson Bulletin, XLI, p. 245, 1929).

Tennessee Warbler. *Vermivora peregrina.* Two late records for 1928 are of single birds observed June 4, in Crocker Woods, Des Moines, and on June 6, Ledges State Park, south of Boone.

Orange-crowned Warbler. *Vermivora celata celata.* A male collected in Des Moines, June 6, 1929. This is over three weeks later than the previous late spring record for Polk County. Its song sounded like a cross between the songs of the Tennessee and Pine Warblers—a soft trill ending with an ascending note. The specimen is now in Mr. Nelson's collection.

Grinnell's Water-thrush. *Seiurus noveboracensis notabilis.* A single bird observed at Long Pond on June 6, 1928, apparently a late migrant, as the only typical breeding grounds of this species was several miles away. In 1929 a pair of these birds was seen at Camp Mitigwa, north of Woodward, June 13. As both birds were carrying food we suspected that they had young in a nearby nest.

Mourning Warbler. *Oporornis philadelphia.* A male seen at Camp Mitigwa on June 13, 1929. There was no proof that this bird was anything other than a late migrant.

Eastern Savannah Sparrow. *Passerculus sandwichensis savanna.* A juvenal, probably out of the nest at least ten days, was observed with one adult along the west side of Little Wall Lake on June 12, 1928.

Nelson's Sparrow. *Ammospiza caudacuta nelsoni.* One bird was noted at Long Pond and another at a small pond two miles south on June 12, 1928. It seemed likely that birds present at that date were breeding but no nests were found. A single bird flushed from the edge of the marsh at East 14th Street and Euclid Avenue, Des Moines, May 27, 1929.

Museum of Vertebrate Zoology, University of California,
Berkeley, California.

THE WILSON BULLETIN

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The present editorial organization is as follows: T. C. Stephens, Editor-in-Chief, Sioux City, Iowa; Myron H. Swenk, University of Nebraska, Lincoln, Nebraska; Albert F. Ganier, Nashville, Tennessee; Alfred M. Bailey, Chicago Academy of Sciences, Chicago, Illinois; R. D. Hissong, Sioux City, Iowa.

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EDITORIAL

The Annual Meeting at Columbus

The next annual meeting of the Club will be held at Columbus, Ohio, on the three days following Thanksgiving Day. The program and business sessions will occupy Friday and Saturday, November 25-26; and on Sunday a visit will be made to Buckeye Lake, which is an interesting inland body of water, about thirty square miles in extent. In the vicinity of this lake 285 species of birds have been recorded.

The sessions will be held in the splendid auditorium of the Ohio State Museum on the Ohio State University campus. Mr. E. S. Thomas, Curator of Natural History, will act as guide to the numerous exhibits of interest to ornithologists. (The Editor especially recommends that visitors be sure to see the extensive collection of Indian effigy pipes, carved in imitation of many species of birds). Plans are being made to have a display of paintings and photographs by members, and those who desire to participate are invited to communicate with the Secretary.

The large membership in Ohio and adjoining states is an assurance that the meeting this year will be well attended, notwithstanding adverse general conditions. It is expected that the total registration will not fall much below that of other recent meetings.

There will not be another issue of the Bulletin prior to the meeting, but the Secretary's annual letter will give details concerning the program, hotel headquarters, etc. The officers are now at work on the program, and we urge our members to make an early report to the Secretary concerning any contribution to the program. Papers of all types are desired, and especially those illustrated with slides or movies of general interest.

In order to extend our usefulness as well as to keep up our finances we are anxious to enlarge our membership. To this end every member is requested to recommend to the Secretary at least one prospective member. This is the most effective means of developing the organization, and we do not believe that our resources are by any means yet exhausted.

One of the Pleasures in bird study is the general fact that every day of field work brings some new bit of information to the observer's experience. The truth of that will be well known to every field worker. Very few would wish to deny that experience of growth. We live in constant hope and expectation that we will have the same experience of discovery and growth tomorrow, and the day after, throughout all the future. This could not be so if it were possible for us to gather all knowledge within any limited period of time. It has been the invariable human experience in the past that individual mental development, as well as collective human knowledge, has been gradual and cumulative. Upon the basis of this experience we entertain a hope and prediction for the future. How vain is, therefore, the mortal who holds himself in conceit, and looks with disdain or condescension upon his fellow-worker.

Literary Contributions are so necessary to the maintenance of the Bulletin that any thought of offering general criticism of authors' technique may well be questioned. However, it is with the spirit of mutual helpfulness that the Editor ventures to make a few suggestions. No matter how experienced and skilful a writer may be his manuscript is almost sure to require some editing to bring it into conformity with the style of the magazine to which it is submitted. Many authors study the style of the magazine in which they expect to publish. Doubtless different authors use all degrees of care in preparing a paper for publication. It was our thought to suggest that a manuscript should not be submitted for publication until it had been revised at least three times; once for elimination and condensation; again for clearness. Then the second revision should be read three times, once for syntax, once for capitalization and spelling, and once for punctuation. It may now be revised to include these corrections. There is little doubt that many scientific papers are revised a dozen times or more before publication. Then the author may typewrite it, double-spaced, on good paper (not thin, flimsy stuff), and send the original (not the carbon copy) to the Editor.

During Mr. Ridgway's Life he succeeded in issuing the volumes of "The Birds of North and Middle America" about every three years on the average, until eight volumes had been published. Mr. Ridgway had completed his work on the ninth volume three or four years before his death; so, this work has been allowed to remain unpublished for perhaps seven years. We hope it is not the intention to abandon this publication entirely. The set should be completed. There is no work so complete in the treatment of distribution and synonomy, and it is essential for reference in these matters. In the interest of scientific convenience it should be carried on to completion.

GENERAL NOTES

Conducted by M. H. Swenk

A Late Date for the Chimney Swift in Indiana.—Last fall (1931) during a warm spell, we saw a pair of Chimney Swifts (*Chaetura pelagica*) fluttering in the air one Sunday afternoon, and the date was November 20. That was the latest record I have ever known these birds to be seen in this part of the country.—Mrs. Horace P. Cook, *Anderson, Ind.*

Two Iowa Duck Records.—On November 15, 1928, Dr. E. M. MacEwen shot a duck near Lone Tree, Iowa, that was identified as a cross between a Mallard and a Pintail. The duck was sent to W. T. Hornaday, who verified the identification. It is now on display at the University of Iowa.

In the fall of 1931 a duck was shot by a Mr. Wendell of Estherville, Iowa, which was probably a Fulvous Tree Duck (*Dendrocygna fulva*). The duck was taken to F. P. Hopkins of Spirit Lake. While Mr. Hopkins is not an ornithologist he is a very careful amateur ichthyologist and understands the importance of care in identifying unusual species. He said that the duck was shot from a tree. Its legs were about twice as long as those of a teal and blue-black in color. Its bill was short, dark and somewhat broad. The rest of the description also fitted the Fulvous Tree Duck exactly. Unfortunately the duck was not saved. I believe that this bird should be included in future state lists as a hypothetical record.—F. L. R. Roberts, *Iowa City, Iowa.*

Great Horned Owls Dying in the Wild from Diseases.—On February 21, 1932, in the course of some raptor studies east of Prairie du Sac, Wisconsin, a nesting Great Horned Owl (feathers plucked from underparts) was found freshly dead and intact beneath a favorite roost tree. It lay with ventral surface on the ground, wings partially spread and talons about half closed. Careful examination preceded by plucking proved that the bird was in full flesh and bore no external injuries of any sort. Hippoboscid (blood sucking) flies off the carcass were conspicuous and active. The most recent pellet was smaller than the usual size, and, judging by the mucus, probably less than forty-eight hours old.

This owl was sent to Dr. R. G. Green, Univeristy of Minnesota bacteriologist, who has been making a specialty of wild life diseases. He reported in a letter: "The liver was normal in size, showed some congestion and numerous fine necrotic areas. The spleen was greatly enlarged and thickly packed with small discrete abscesses of varying size. All other organs appeared normal." A captive Great Horned Owl and a Screech Owl succumbed to inoculation with infective material. A captive Barred Owl, likewise inoculated, seemed immune. Dr. Green told me orally that the disease was not tularemia (to which none of his experimental raptors have as yet shown susceptibility), and that the evidence indicates a virus, possibly specific for certain owls. He will publish elsewhere the technical data from his investigation.

Unfortunately, I did not again visit the owl territory until April 6, when the remains of the second Great Horned Owl—the mate of the first—were discovered, also under one of the habitually used roost trees. Only the wings and a picked and bleached sternum could be located, so the specimen cannot be said to have had more than limited diagnostic value. At any rate, both members of the pair were then accounted for; both apparently dead within a short time of each other, presumably victims of the same contagion.—Paul L. Errington, *Madison, Wis.*

Recent Changes in South Dakota Bird Life.—Many South Dakota lakes are rather low at this time (1931), due to the dry summer of 1930. Other lakes are entirely dry and the effect on bird life is very noticeable. Lake Albert, in Kingsbury County, was formerly the home of a large colony of Double-crested Cormorants, but at present the lake is a huge flax field. The cormorant colony on Dry Lake, north of Lake Albert, is also gone, probably due to molestation. The remnants of the two colonies just mentioned selected a rocky island in nearby Lake Poinsett, and here several hundred birds are nesting. A fine colony of Western Grebes was, however, found on Dry Lake.

Roy Lake, northeast of the Waubay Lakes, was once the site of a fair-sized cormorant colony, but fishermen decided the birds were too fond of fish, and the colony was shot out during 1930. The remnants of this colony has evidently settled on Cattail Lake, near old Fort Sisseton, and has easily doubled the size of the old colony at this place.

The fine cormorant colony on South Waubay Lake is probably the largest colony left in the United States. This season Mr. Arthur Lundquist, of Webster, South Dakota, and the writer found nearly 700 nests on the two islands. The Ring-billed Gulls on the larger island seemed to be back in larger numbers, and several hundred nesting birds were seen. The large colony of Common Terns has, however, almost deserted this island, and less than a dozen pairs were there nesting this year (1931).

In general the water and shore birds are decreasing in this area. Duck nests were less numerous than usual this year. Holboell's and Eared Grebes seemed less numerous than in other years. Western Grebes appeared more abundant on Rush Lake, but this was no doubt due to the fact, that this species was not nesting on South Waubay Lake, or on other lakes and sloughs where it had formerly nested. The Western Grebes chose Rush Lake for a breeding ground this year and it appears that most of the grebes of this region have come to the above lake this summer.

Western Willets and Upland Plovers were not seen in the usual numbers, but the Marbled Godwit was apparently present in about its usual numbers. Clay-colored Sparrows were found nesting in several likely places. The Prairie Marsh Wren and the Short-billed Marsh Wren were seen in many marshy areas, the former being much the more common. A male Nelson's Sparrow, in breeding condition, was taken at Rush Lake, on June 7, 1931.—William Youngworth, *Sioux City, Iowa.*

Woodcocks and Wood Ducks in Washington County, Iowa.—While patroling on Skunk River on July 14, 1932, my spaniel flushed a Woodcock within fifteen or twenty yards of me, and another not over that far from the first one. They flew not over fifty yards and lit near each other. I called the dog in because they acted as if they had young there, and backed up for fear the dog would catch their young. It was in large elm timber on low, wet bottom ground and with some heavy cover, near the county line between Washington and Keokuk Counties, Iowa.

I am a great lover of the woods and of all birds, have a good dog, and get great pleasure in walking along the creeks and rivers. However, this was the first time in fifty-one years here that I have seen a pair of Woodcocks at that time of the year. I can find some in October every year, on the bottom, in moist low

places, and I actually believe there are more coming through here in the fall now than there were years ago.

There are not as many Wood Ducks hatching here as there used to be, but there are some remaining about the Pinoak Ponds whenever we have water to keep the ponds full. Last fall on the Conesville marsh the week before the twentieth of October, the open season, I estimated there were from 400 to 500 Wood Ducks on the upper part of the marsh, and I personally told all the club members there to be careful not to shoot any of them. Only a few of the old hunters know them by their flight any more.—E. L. Breitenbach, *Washington, Iowa.*

The Swallow-tailed Kite in Pottawattamie County, Iowa.—It has now been about two decades since the Northern Swallow-tailed Kite (*Elanoides forficatus forficatus*) has been reported from Iowa. Early in July of 1931 a farmer shot one of these birds along the West Nishnabotna River, a few miles southwest of Oakland, Pottawattamie County, Iowa, and brought it to Mr. Leo Lockhart, of Hancock (a few miles north of Oakland), for mounting. The bird was, however, subsequently sent to the shop of Karl Schwarz, the taxidermist at 419 South 13th Street, Omaha, Nebraska, who mounted it. I first learned of its presence in his shop on July 8, and some time later secured the specimen from Mr. Lockhart, and it is now in my collection. It is a good specimen, and from its size I should judge was a male, the measurements of the mounted bird being in millimeters as follows: Length, 556; wing, 400; tail, 263 (unusually short); tarsus, 30; exposed culmen, 20.5 (from feathers, 27); depth of bill at base, 13.5.—Myron H. Swenk, *Lincoln, Nebr.*

An Experiment with Nesting Purple Grackles.—A great many Purple Grackles (*Quiscalus q. quiscula*) nest in the neighborhood of my yard at Lexington, Virginia. While taking a set of eggs during the spring of 1928, it occurred to me to try the experiment of changing eggs from one nest to another to see if a Purple Grackle would hatch eggs that were not her own. I took six eggs from a nest and replaced them with five eggs from another nest. The bird to which I gave the five new eggs had begun, I think, to incubate her original eggs. One factor that made me more doubtful as to whether my experiment would succeed was that I had kept the five eggs overnight before I decided to try the exchange. I did not, however, remove the original six eggs until I was ready to replace them with the five new ones. The exchange was made early in the afternoon of April 26. Later in the afternoon the bird was on the new set of eggs. She did not lay another egg to bring the number up to that of her original set of six. On May 7 she was still incubating normally. When I returned home on May 12, after an absence of four days, I found that she had hatched out the foster set. The nestlings appeared to be about three days old. The younger birds all lived to leave the nest. The adults, both male and female, were much excited each time that I visited the nest and at times alighted near me in the small tree, with much scolding, but the fact that they reared their young in spite of this exchange of eggs and of my frequent visits seems to show that Purple Grackles are not very sensitive as to nesting conditions.—J. J. Murray, *Lexington, Va.*

Cedar Waxwings Feeding on Ash Flower Stamens.—Approximately forty Cedar Waxwings (*Ampelis cedrorum*) have been stopping for at least the past two days (April 11 and 12) in several rows of ash trees lining a boulevard in the south part of Kansas City. The trees are bare of leaves but the staminate flowers are just beginning to shed their pollen. The waxwings are gorging on the mature stamens. They perch among the branches of the comparatively small trees and pay little attention to passersby, whether they be on foot or in motor cars. Occasionally they reach out for another beak full of flower stamens. Three weeks ago waxwings were seen in the neighborhood, feeding on small rotted apples still hanging on the trees.—A. E. Shirling, *Kansas City, Mo.*

A New York Ring-necked Pheasant Census.—On April 25, 1930, while traveling from Geneva to Rochester, New York, a count was made of the number of Ring-necked Pheasants occurring within a defined area extending parallel to the Lehigh Railroad. On April 30, another count was made over the same territory, while traveling from Rochester back to Geneva. Conditions for observation were excellent, since at that season of the year there were no crops or leaves on the trees to in any way obstruct the view. The birds were very tame, seemingly, and continued to feed and move about in the fields, very little affected by the presence of the passing train. An attempt was made to count all birds within the limits of one-tenth of a mile on one side of the passing train, from a window of which these notes were recorded. A record was kept of the nature of the groupings of the birds, in order if possible to apprehend any dearth in the number of breeding males as compared to the total estimated population.

Between Geneva and Rochester a total of fifty birds were counted. Of these twenty-two were male birds. The following groupings were recorded: Eleven males were each alone; four males were each accompanied by one hen; five males were each accompanied by two hens; one male was accompanied by four hens; one male was accompanied by six hens; four hens were each alone.

Between Rochester and Geneva a total of fifty-one birds were counted, of which twenty-six were males. They were distributed in groups as follows: Thirteen males were each alone; four males were each accompanied by one hen; two males were each accompanied by two hens; two males were each accompanied by three hens; one male was accompanied by five hens; four males were fighting (two different sets); two hens were each alone; three hens were in one flock.

The total distance between Geneva and Rochester is 40.6 miles. Observations were limited as nearly as possible to an area one-tenth of a mile wide. Thus, for a total area of 4.06 square miles, these figures show an approximate pheasant population of thirteen birds per square mile.

Regarding the number of males, twenty-two were counted on the first trip, and twenty-six on the second. If twenty-four were taken as the average number, there would be approximately six breeding males per square mile. While it is comparatively easy to overlook an occasional female in making such a count, I believe that the number of males counted represents a fairly accurate account of the number existing over that area at that time. Nowhere in the state have I seen the Ring-necked Pheasant as numerous, although there are few areas over which it would be so easy to count the birds as in the flat agricultural region about Rochester.—R. G. Johnson, *Oneonta, N. Y.*

Double and Triple Nests of the Red-winged Blackbird.—This prairie town has no water near except the artificial lake for the city water supply. On the banks of this lake I find colonies of the Red-winged Blackbird. The first of these nests I find very low, and band the young about the first of May, but as the season advances I find the nests higher, several of them placed in willows or mesquite at a height of eight or ten feet. The last banding this season (1931) was on July 12. In the cattails I found several two-story nests and one of three stories (see illustration). Each nest was perfect, and I banded nestlings from the last two.—Mrs. Jack Hagar, *Corsicana, Tex.*

The Chipmunk as an Enemy of Birds.—We all know that birds have many enemies. However, I thought that I was aware of most of them, and liking birds on the whole better than I do their persecutors, I have always aided the birds as much as possible. But I was a bit surprised on May 8, 1929, when I was forced to catalog a new enemy of bird life, a creature that until that time I had considered free of guilt as far as taking the life of a bird was concerned.

My patch of Cumberland raspberries is situated less than a stone's throw east of the house, and being properly pruned each season, the bushes afforded several species of bramble-loving birds splendid nesting sites each spring. Some time prior to the date mentioned, a pair of Cardinals (*Richmondena cardinalis*) had selected a clump of raspberries that suited them, and had built a nest in it.

I watched the nest closely from the beginning, knew when the first egg was laid, saw them through the period of incubation, and, at last, saw the nest filled almost to overflowing with three hungry young Cardinals. They were large, so heavy that the insecurely fastened nest tilted to one side, when the tragedy occurred, early in the morning. I heard the clamor of the parent birds and rushed down. The nest still contained one bird, another on the ground was injured, but living, and the whereabouts of the third was shown me by the actions of the female Cardinal. A fence with one-inch mesh surrounded the raspberry patch, and I saw her, fluttering and crying frantically, apparently trying to rush through the fence head foremost. She flew away when I arrived but mother love asserted itself shortly, and she was back, hovering near me, crying piteously as I extricated from the mesh of the fence all that remained of the lifeless young Cardinal. But I had seen the culprit! That black-striped back gave him away as he, noting my approach, ceased struggling in the attempt to pull a too large young Cardinal through the fence, and hurried back to his old home in the brush pile below the path. The enemy was a Chipmunk, a fellow that I had considered neutral, if I did not call him a friend. Nature had taught me something more. His home was destroyed and later he went the way of many

other enemies of my birds. Chipmunks have been added to the black list now.

I righted the nest of the Cardinals and replaced the injured young one, but it did not live. However, the parent birds did not desert the sole survivor of the tragedy. A few mornings later they had induced him to try his wings, and I saw the solitary youngster, shortly after sunup, sitting on a post beside the path that leads into the hollow.—Grant Henderson, *Greensburg, Ind.*

The Great Blue Heron Flops on Its Prey.—Late one afternoon we sat in an automobile south of Lake George, New York, and had an excellent opportunity of watching the fishing movements of a Great Blue Heron (*Ardea herodias herodias*) in a small stream about sixty feet away. The heron walked very stealthily in the water beside some reeds, and was in full view. The water was about three inches deep there. As each foot was raised from the water the toes hung vertically and limp; then were flattened out before touching the surface in the forward step. The heron held its head quietly, except with a forward swing with each step, and with the bill at an angle of about forty-five degrees. Suddenly it seemed to drop upon its prey. In this act it bent its knees and ankles together to bring the force of its weight into the thrust. Its action was not entirely a neck motion, with the body revolving or tilting on the fulcrum of the hip joint, but was a whole dropping of the body. Its entire head was immersed. When it came up it had a fish at least six inches long. It appeared to have thrust its bill, or one blade at least, through the fish. The heron carried the struggling fish to shallower water and appeared to stab it two or three times. Then juggling it into the right position, it was swallowed head first, and the bird resumed its fishing. The lump in the throat was seen to go down. A few minutes later the Heron caught a minnow in the same manner.—Harold B. Wood, *Harrisburg, Pa.*

The Blue-gray Gnatcatcher Moves Its Nest.—Much has been published lately in the Wilson Bulletin in regard to the nesting of the Blue-gray Gnatcatcher (*Polioptila caerulea caerulea*). On May 15, 1932, I observed the nest of a Blue-gray Gnatcatcher in a small elm tree twenty-two feet from the ground. The male and female were both seen. The same day, and about 200 yards from the gnatcatcher's nest, I found the nest of a Green Heron (*Butorides virescens virescens*) the female being on the nest.

One week later, on May 22, 1932, I again visited this locality. The Green Heron's nest was gone, having been robbed and the nest thrown to the ground. These birds then built another nest in the same tree that contained the gnatcatcher's nest and about twelve feet from it. While looking for the latter nest, one of the gnatcatchers suddenly appeared and flew to the spot where the nest originally had been. Gathering a piece of nesting material in its bill it flew away, but in a short time returned. The nest at this time was almost gone, only the bottom part of it remaining.

That they do remove their nests to other situations is almost certain, as in this case the Green Heron having built close to the gnatcatcher's nest, made them change their location. Another thing I have observed about these birds, is that they generally build their nests from ten days to two weeks before laying their eggs. This I think is due to the fact that they nest early (in this locality) and do not deposit eggs until the trees are well leafed out.—C. K. Lloyd, *Oxford, Ohio.*

Some Corrections and Additions to the New A. O. U. Check-List.—The following are some corrections and additions to the recent (1931) fourth edition of the A. O. U. Check-List:

Page 25. Man-o'-war-bird. (*Fregata magnificens*). Breeds on different keys in Monroe County in different years, and has for over ten years to my knowledge, on Bird Key, outside of the railway trestle, in 1931.

Page 31. American Bittern (*Botaurus lentiginosus*). Breeds in Dade County, southern Florida.

Page 67. Insular Red-shouldered Hawk (*Buteo lineatus extimus*). The range as given, Florida Keys, is very inaccurate, for it breeds only sparingly on the keys, and commonly on the mainland, as far northward as a line across the state from Palm Beach to Fort Myers. Above that line, breeding birds are nearer *B. l. alleni* than *extimus*.

Page 68. Swainson's Hawk (*Buteo swainsoni*). Florida range, given as "casual", should be changed to "a regular migrant".

Page 72. Marsh Hawk (*Circus hudsonius*). This bird breeds sparingly in Dade County, southern Florida.

Page 77. Little Sparrow Hawk (*Falco sparverius paulus*). True typical *paulus* breeds in Florida only north to a line across the state north of Lake Okeechobee; above that it intergrades with *F. s. sparverius*.

Page 101. Mexican Jacana (*Jacana spinosa gymnostoma*). The Check-List questions the subspecific identity of C. B. Cory's record of this bird. My father, the late H. B. Bailey, recorded a Jacana seen on his trip, by skiff, from Kissimee to Fort Myers, in March, 1911. (See "Birds of Florida", page 59). Any field identification given by him, especially of such a bird as this, can be relied upon, for few men had his faculty for identifying birds correctly in the field, and his notes were never questioned.

Page 114. Spotted Sandpiper (*Actitis macularia*). This species should have been given as breeding in Florida, where I have taken the downy young. ("Birds of Florida", page 54).

Page 134. Franklin's Gull (*Larus pipixcan*). Winters from Florida Bay and the Gulf Coast of Florida southward.

Page 151. White-crowned Pigeon (*Columba leucocephala*). This pigeon has been a regular breeder on several of the smaller keys in Florida Bay for many years, and also on main Key Largo (1930-31), it is a regular winter resident on the mainland in Monroe County, where it comes for the hardwood native berries and food similar to that which is to be found on the keys.

Page 152. Scaled Pigeon (*Columba squamosa*). The two records as given from Key West, were undoubtedly escaped caged birds brought over from Cuba by the tobacco workers, as were several other varieties of Cuban doves.

Page 154. Ringed Turtle Dove (*Streptopelia risoria*). This dove is a common breeder also at Miami Beach and some of the islands in Biscayne Bay, and a few breed at Miami proper, since I recorded it in the *Oologist*, page 91, volume 29, 1922.

Page 157. The Key West, Ruddy, and Blue-headed Quail Doves, as recorded from Florida, were undoubtedly all escaped caged birds brought over from Cuba by the tobacco workers living and working at Key West. I have had many of each variety in captivity the past few years, and have secured many more for friends, hoping to breed them before they become exterminated. The wing

structure of these varieties, and their habits as well, dispel all chance of their having migrated or been blown into Florida by a tropical storm.

Page 160. Black-billed Cuckoo (*Coccyzus erythropthalmus*). Breeds south of the Georgia-Florida line, north of Gainesville and Lake City, where I have seen young and old the first week in July.

Page 206. Eastern Phoebe (*Sayornis phoebe*). Breeds south in Florida to below Lake City, where I have found young in the nest in July, in the usual manner, under bridges.

Page 223. Florida Jay (*Aphelocoma coerulescens*). The range of this bird, as given, is misleading, for it is not found on the peninsula of Florida below scrub oak territory, which is Lemon City (northern part of Miami City) on the East Coast, and the peninsula extends over a hundred miles farther south and is commonly known as Tropical Florida.

Page 229. Black-capped Chickadee (*Penthestes atricapillus atricapillus*). The range as given (Alleghanies south to North Carolina) is erroneous. Breeding birds taken at Mountain Lake, Giles County, Virginia (altitude 4000 feet) on May 28, 1913, and submitted to Dr. Witmer Stone for identification, were identified as, and are, *P. carolinensis carolinensis*. (See "Birds of Virginia", page 344). Evidently this has been overlooked by Dr. Stone, or slipped his memory.

Page 251. Catbird (*Dumetella carolinensis*). Northern Florida, as given, is not correct, for they breed southward to Fort Lauderdale, and since my "Birds of Florida" (1925) book came out, I have found a single pair breeding as far south as Cape Sable, Monroe County, in 1926.

Page 252. Brown Thrasher (*Toxostoma rufum*). This bird breeds sparingly to Cutler, Dade County, and in one case at Cape Sable, Monroe County, in 1926.

Page 274. Key West Vireo (*Vireo griseus maynardi*). This vireo breeds in Dade County northward at least as far as the Tamiami Trail, resorting to the hardwood hammocks, similar to the foliage of the keys farther south .

Page 292. Collins's Warbler (*Dendroica discolor collinsi*). The vernacular name given this bird was "Collins's Warbler" not "Florida Prairie Warbler", as given in the Check-List.

Page 294. Kentucky Warbler (*Oporornis formosus*). Breeds in northern and northwestern Florida, sparingly.

Page 303. Red-winged Blackbirds (*Agelaius* subspp.). There is still a great deal of work to be done with the several subspecies found in the state of Florida. I do not agree with the ranges or races of several Florida birds, as given in the Check-List.

Page 307. Baltimore Oriole (*Icterus galbula*). This bird breeds sparingly in northern Florida, between Lake City and the Georgia line, where nests with young have been noted.

Page 309. Eastern Cowbird (*Molothrus ater ater*). Breeds as far south as Cape Sable, Monroe County, where I have taken one record.

Page 326. Pine Siskin (*Spinus pinus pinus*). This range as given is misleading, for while I resided at San Francisco, California, 1902-05, many sets of eggs were taken with birds by several collectors, from an area bordering San Francisco Bay, adjacent to, and little above tidewater.

Page 339. Shannon's Seaside Sparrow (*Ammospiza maritima shannoni*). This new race from the seacoast of northeast Florida changes the range as given

for *A. m. macgillivraii.* (Bulletin No. 7, Bailey Museum of Natural History, August, 1931).

Page 363. Snow Bunting (*Plectrophenax nivalis*). The C. B. Cory record of this bird in Florida is of doubtful value, and should not have been used, unless in the Florida hypothetical list. This record was gone into thoroughly by the writer when working on the "Birds of Florida", and after all facts were known, it was thought best to eliminate it.—Harold H. Bailey, *Miami, Florida.*

The Nesting Behavior of a Pair of Mockingbirds.—The Mockingbird (*Mimus polyglottos polyglottos*) is locally an abundant migrant and fairly common summer resident, while a few males winter here. An increase in recent years in the number of migrants would indicate a northward extension of the species. One male individual that winters here is recognizable by his song, for he is a master artist in his imitations of other birds. Throughout the year at no time does he wander more than within a radius of a half mile. In the winter he skulks shyly through the bare trees in a weird manner, and at sight of another bird gives his warning note, which is the only one used throughout the winter.

On February 22, 1929, he commenced crooning, and this was kept up until the first week in March when his ecstatic joy was shown by his impassioned outbursts of song. About this time he began to investigate nesting sites. He devoted most of his time inspecting a neighbor's climbing rosebush. After the arrival of his mate, on April 3, they both continued the search, but did not come to a decision until the latter part of April, when they chose to place their home very near the street, in a rosebush in my own yard.

The nest was placed three feet from the ground. They did not notice the traffic while building, but while nesting the sitting bird flew off every time a vehicle passed. On April 28, a dark, cloudy day, I noticed the pair picking up twig ends of a last year's locust in the yard. These twig ends were about four inches long and were carried far back in the bill at about the middle of the twig. They flew first to the fence about a foot from the nest, and then to the nest, putting the twigs in place. Both seemed to be taking the same interest in building.

When first observed the nest was fairly well started. The nest was completed by April 30 and apparently was then deserted. The outer layer was composed entirely of the locust twigs, the inner layer was of small rootlets, and between these was a thin layer of moss. This mossy layer is in every Mockingbird's nest that I have ever examined in this vicinity.

But they returned on May 4. On May 5, 6, and 7 an egg was deposited each day. The squirrels kept bothering them, and finally destroyed two of the eggs. On May 15 the nest was deserted and on the same day another one was commenced in the neighbor's climbing rose. This nest was placed seven feet from the ground. The usual height in this vicinity is three feet.

When the female commenced incubation the male chose a walnut tree 350 feet away for a perching and singing tree. He stayed most of the time in the tree, skulking through its branches and frequently roaming through the neighborhood. When the eggs were hatched he commenced his irrepressible singing, keeping it up most of the day and for several hours at night. The song of day was mellowed by the heat and other noises into a fascinating silvery melody, while in the quiet hours of the night the bold, clear notes were strikingly intensified.

The young left the nest on June 19. They were joined by the male, and for three or four days the family stayed in the yard. They then left for a vacant lot, where they remained for three or four weeks. Then the female abandoned them, to return to her old nest and raise another family. The same family routine was repeated as in the first, until the brood left on August 18. The male again joined his family in the yard and then to the vacant lot, where they remained together until migration.—Katie M. Roads, *Hillsboro, Ohio.*

The Re-use of Nest Material.—Mr. John B. Lewis, in the June issue of the Wilson Bulletin, notes the disappearance of Blue-gray Gnatcatchers' and Ruby-throated Hummingbirds' nests after the young had left and his observations suggest the re-use of the material either by the original builder or another bird of the same species. Another cause for the disappearance of such nests may be suggested by the occurrence in two instances of an old Wood Pewee's nest as an interior ornament of a Red-shouldered Hawk's nest. Description of a nest found in Jefferson Township, Cook County, Illinois, April 16, 1893, mentions this detail, and that of another found in Northfield Township, in the same county, April 10, 1898, also notes it. Perhaps an old lichen-covered nest attracts hawks as snake-skins do Crested Flycatchers. Incidentally, the circumstance that I have found onion skins and bits of waxed paper in the nests of the latter species, prompts the thought that it is not because it is a snake-skin but because of its glitter that the object is picked up.—Edward R. Ford, *Chicago, Ill.*

An Encounter Between a Cooper's Hawk and a Horned Owl.—On July 7, 1931, I was visiting a juvenile Great Horned Owl that had previously been tethered on the ground for a study of its food habits in a woodlot west of Pine Bluff, Wisconsin. The adult owl that was taking care of the youngster appeared at my approach, alighted in a tree near by, and started the usual hostile demonstration of hooting and bill snapping. As if in answer to the hoots, the cry of a Cooper's Hawk came from deeper in the woods, and an instant later a female hawk dashed at the adult owl with terrific speed. Like a skilled boxer, the owl ducked, barely evading the hawk's talons. Several times in very short order the owl had to dodge as the raging hawk struck from all sides.

During the first part of this performance, the owl had been nearly as much concerned on account of my proximity to the juvenile as it had been with the attacks of the Cooper's Hawk. Finally, things became sufficiently hot that the owl left the branch upon which it had perched, and launched forth in direct and purposeful chase of the Cooper's Hawk, which kept just ahead of her larger pursuer for several yards before doubling back, to wheel and strike again. The hawk behaved as though utterly maddened, but she never let herself get quite within reach of the owl's talons. Her safety was plainly dependent upon her superior agility and precision of movement. For a brief space the action became so fast that I could not see exactly what was happening, especially at close quarters when it seemed that neither bird could avoid being hit. However, it is improbable that damage was done, for not even a feather was noted to fall. The hawk soon went her way, cackling as she flew, and the owl was free once more to center upon me its earnest attention. The hawk gave no evidence of having seen me.

A search of a few minutes revealed the hawk's nest 110 yards away. Two juveniles, ready to fly, were perched on the rim.—Paul L. Errington, *Ames, Iowa.*

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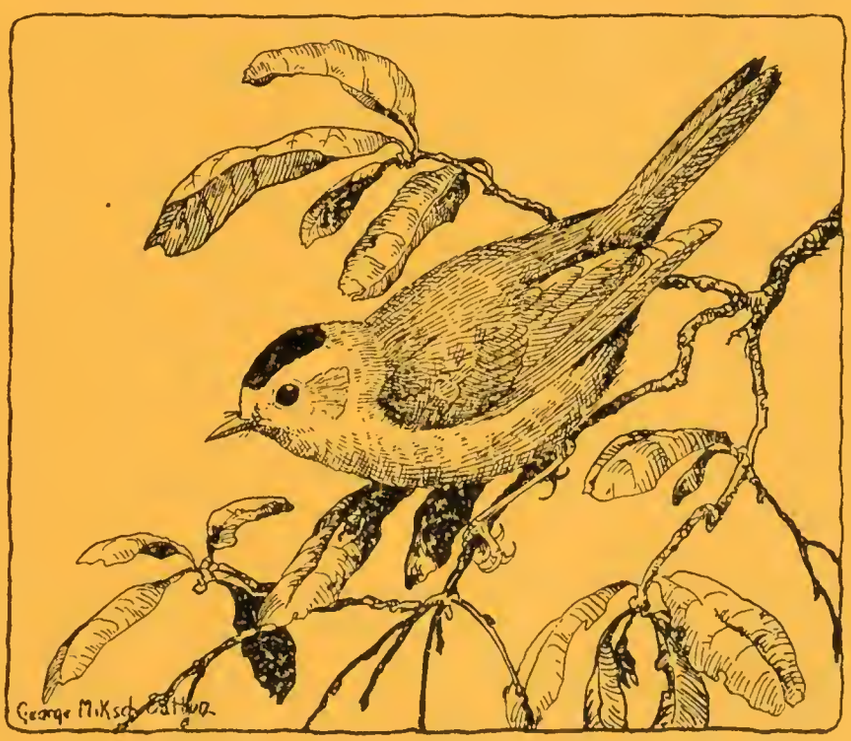

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THE PHYSIOLOGY OF FEATHER PATTERN

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I. INTRODUCTION

In coöperation with colleagues, whose work will be discussed in the following pages, I have been engaged during the last ten years in studying the manifestations and control of sexual characteristics in the Brown Leghorn fowl chiefly. The characters of the highly dimorphic plumage have engaged our attention from the start, and the readiness of control of plumage sex-characteristics led us to make a special study of the mechanisms concerned. This resulted in the discovery that differences of rate of growth of different feather tracts are highly determinative for the threshold of reaction to the female sex hormone (Juhn and Gustavson, 1930; Juhn, Faulkner, and Gustavson, 1931). The idea then occurred to me that differences in the rates of growth of parts of the individual feather might similarly be an important factor in the determination of its pattern, whether sexual or not; and an extended analysis of development and growth of feathers confirmed this

theory (Lillie and Juhn, 1932). It has been suggested to me that the principles involved should be of general interest to ornithologists.

It should be stated at the start that the range of physiological determination (by hormones, other physiological conditions of the organism, and environment) is limited by genetic determiners, which include, in my opinion, not only the general genetic make-up of the organism, but also the skin mosaic factors responsible for the formation of different feather types in different tracts, as for instance in the saddle and breast of male Leghorns or capons. Nevertheless, the range of physiological determination of feather structure and pattern is very considerable. The analysis of experimentally determined variations may be expected to throw some light also upon the principles determining natural feather pattern.

In the experiments the female sex hormone and crystalline thyroxin were used. Injections of these produce specific effects on feathers, showing wide quantitative ranges dependent on concentration. Males or capons of the Brown Leghorn fowl were used exclusively for the experiments. The female sex hormone was prepared by our coöperating biochemist, Dr. R. G. Gustavson, from placenta or human pregnancy urine. It should be recalled in this connection that male hormone is without noticeable effect on the plumage of this breed of fowl, and that the plumage of the capon or poularde is the same as the male in all major aspects. The effect of the female hormone is to induce the female form, structure and pattern, specific for each feather tract, in all regenerating feathers, so long as its concentration is above the threshold of reaction. Thyroxin, "in physiological doses", produces definite pattern effects, more especially in the "lacy" feathers of the saddle, back, and neck.

These hormones are administered by subcutaneous injections. There is, therefore, always a period of absorption during which the concentration of the substance is rising in the blood to a maximum, dependent on the dose, and a period of excretion during which the concentration of the substance in the blood is sinking. An "intensity curve" can be used to picture these conditions (see Fig. 52). If the maximum is above the "threshold of reaction", a definite effect is produced, the quantity of which is dependent on the duration of threshold-concentration. The effect begins to manifest itself after a variable latent period, if concentration in the blood is above the minimum for reaction (threshold); and increases as concentration rises to the maximum, then decreasing again to disappearance. The result of

this is to establish a symmetrical mark in the vane of the feather. Accurately measured amounts of hormone were always used.

It is obvious that by suitably repeated injections the level of concentration of hormone in the blood may be kept constant, or caused to fluctuate up or down as desired. A great variety of patterns may thus be produced.

For the interpretation of the results knowledge of the *mechanics* of development of the feather is necessary. As this was substantially unknown, a detailed study of the development of the feather was necessary (Lillie and Juhn, 1932).

In all of the studies summarized here regenerating feathers of males or capons were used. Feathers regenerate promptly at any season of the year at constant rates. In order to obtain any desired stage for study of hormone effects, definite feathers are plucked at known periods of time before beginning any experiment, and preserved for comparison with the experimental regenerating feathers. The results can thus be compared with the predecessor feather, from the same follicle if desired. The record is completed after regeneration by preserving the experimental feathers also.

We may divide our review into two parts, the first dealing with plumage areas, the second with the individual feathers.

II. Plumage Areas

We shall discuss this subject briefly, and only with reference to areal gynandromorphism; but it deserves attention because the principle of relationship between rate of growth and threshold of reaction was first discovered here. Domm (1927) observed that in the reversion from male type plumage, which follows sinistral ovariotomy, to female type, which develops more or less completely at a later time, feathers of the back and saddle may be first affected; however, no special attention was given to this phenomenon. Juhn and Gustavson (1930) found in their experiments of injection of female hormone into capons, that, when a series of daily injections was interrupted for a day, the regenerating breast feathers recorded the interruption by temporary reversion to male type, while the regenerating saddle feathers remained pure female in type. They interpreted this to mean that excretion of the female hormone during the interruption had reduced the concentration in the blood below the threshold of reaction for the breast feathers, but not below the threshold for the saddle feathers; in other words, that the breast feathers had a higher threshold of reaction than the saddle feathers. They found also that it was possible to induce

Fig. 38. Rate of growth of feathers in length in the male Brown Leghorn. The four curves represent the average daily increase in length of twenty feathers in each of four regions from the twelfth to the forty-ninth days of regeneration. P. Br. is for postrior breast region; A. Br., anterior breast; S., saddle; B., back; abscissae, in days; ordinates, in millimeters. From Juhn, Faulkner and Gustavson, 1931.

hen-feathering in the saddle with a low concentration of female hormone in the blood, that did not affect the breast feathers at all; and thus confirmed the conclusion. They also noted that breast feathers grow at a much more rapid rate than saddle feathers and suggested a causal relationship between rate of growth and threshold of reaction.

Juhn, Faulkner, and Gustavson (1931) then made an extended study of this subject. They studied average daily rates of growth in the posterior part of the breast, the anterior part of the breast, in the back, and in the saddle. The results are shown in the accompanying graph (Fig. 38). By a long series of experiments they then determined that there is a direct relationship between the growth rates of the male feathers and the concentration of female hormone in the blood required to change the type of the regenerating feather from male to female. The relationship is, in fact, roughly proportional to the linear growth rates recorded, concentrations of about the proportions of 3:4:6 being required for female modification in the saddle, anterior breast, and posterior breast, respectively. These differences are sufficient, in view of the "all-or-none" character of the reactions, to bring about areal gynandromorphism of plumage. They also found an antero-posterior gradient of growth in the plumage of the breast, and medio-dorsal transverse gradients in other feather tracts, as well as in the breast, that were reflected in the results of various experiments.

These results were applied by the writer to the explanation of bilateral gynandromorphism, which has been described in ten distinct cases reported in the literature (Lillie, 1931). He found in four of the cases that a decided hypertrophy of the side bearing the male plumage had been figured or described by the authors; in two of the cases this happened to be the right side and in two it was the left side. In the other cases the conditions of symmetry of the bird's body had not been considered. In all cases, in which the internal anatomy was described, there was evidence of ovarian deficiency, and thus presumably of an abnormally low supply of female hormone. In the more numerous cases of lateral hemihypertrophy known in human subjects there is often, at least, an excessive growth rate of epidermal structures on the hypertrophied side. If we assume that this is the case also for feathers, the principle of relationship between growth rate and threshold of reaction would necessarily determine, in cases of ovarian deficiency of a certain degree, that the more rapidly growing side would produce male feathers and the more slowly growing side female feathers. It is at least certain that the condition can be

explained in principle on the basis of the relationships experimentally determined between growth rates and hormone threshold.

III. The Pattern of the Individual Feather

Although feather patterns are almost infinitely diversified, there are undoubtedly certain fundamental physiological principles that underlie all. The physiological analysis to be presented is based upon experiments with one breed of fowl; nevertheless the fundamental factors are present here as they would be in any other case; and it would probably be possible to reach a common agreement as to what they are. Assuming this, it will be seen that the analysis is probably significant for the interpretation of feather pattern in general. In each case there are certain genetic and mosaic factors pertaining to species, race, and feather tract that are special; for the purpose of physiological analysis these are taken for granted.

Like the entire organism the feather is a bilateral structure with a more or less pronounced tendency to asymmetry both in form and pattern. All of its variations and modifications are to be referred to its axis (the rhachis), to its apical and basal ends, to its free margin, and to its outer and inner surfaces. The modifications to be considered are restricted to the vane proper. The structural elements concerned are the rhachis, the barbs and barbules, and the pigment.

We shall deal first with experimental modifications of pattern; and afterwards with the development of the feather as a means of interpretation.

1. Experimental modifications.

a. By injections of thyroxin.

The feathers in which the effects of thyroxin are most clearly marked belong to the saddle, back, and neck-hackle tracts of the male or capon. These feathers agree in being long, acuminate, and lacy, i. e., with barbules confined to the basal region of the barbs, to an extent which increases regularly from near the apex to the base of the vane (Fig. 39).

In preparation for the experiment feathers are plucked previously, so that regenerating feathers of known age are present. Accuratcly measured subcutaneous injections of Squibb's crystalline thyroxin are then administered. Figrues 42-46 record the effects of single injections of increasing amounts of thyroxin in saddle feathers of five different birds; the figures are photographs of regenerating feathers plucked several wecks after the injection. The weakest injection (0.5 mg.) is recorded as a narrow spindle-shaped pigmented area

centered on the rhachis; the next (1 mg.) produces a similar but broader mark with its widest point above the center; in the succeeding cases (1.5, 5.0, and 10 mg.) the mark becomes progressively wider until it reaches the margin. The form of the mark records the absorption and excretion of the thyroxin; its modifications through the series are due, so far as width is concerned, to increasing lateral extension with increase in dose, and, so far as its form is concerned, to more rapid absorption than excretion with rising doses. The mark is caused by the extension of barbule formation farther from the rhachis than normal, and by the formation of large active melanophores wherever barbules appear. It will be noticed also that the feather becomes shorter and broader as a whole with increasing dosage, though even the highest dosage employed is not sufficient to induce premature molting, as excessive doses will do.

The important thing to notice, however, is that there is a decreasing susceptibility to thyroxin in each barb from its base to apex. In other words, the threshold of reaction to thyroxin forms an ascending gradient along each barb. The study of the development of the feather shows conclusively that all levels of forming barbs are present simultaneously at each stage of regeneration, so that the failure of more apical levels to show thyroxin effects with the lower doses can be due to nothing else but a difference in susceptibility.

Interesting patterns can be produced by injections of thyroxin at suitably spaced intervals. Two examples are shown in Figures 40 and 41 in the case of neck hackle feathers. Fig. 39 is a normal control; the pattern in Fig. 40 was produced by injection of 1 mg. thyroxin every seventh day during regeneration, and in Fig. 41 by injection of 1.5 mg. every sixth day. Variations of amount and interval produce yet other variations on the theme.

b. By injections of female hormone.

The female hormone, prepared from sources previously mentioned, affects all kinds of feathers that are sexually dimorphic, causing an abrupt change from male to female type during the period that it is effective. Its action thus differs from the action of thyroxin not only in the number of kinds of feathers affected, but also radically in type of reaction. The changes produced by thyroxin are never of a sexual nature; those produced by the female hormone are always of this nature. However, as only a few factors are concerned (general form of the feather, presence or absence of barbules, presence or absence of chromatophores, and the color and arrangement of the pigment produced) superficial resemblances between the effects of thyroxin and of female hormone do appear, especially in the lacy feathers.

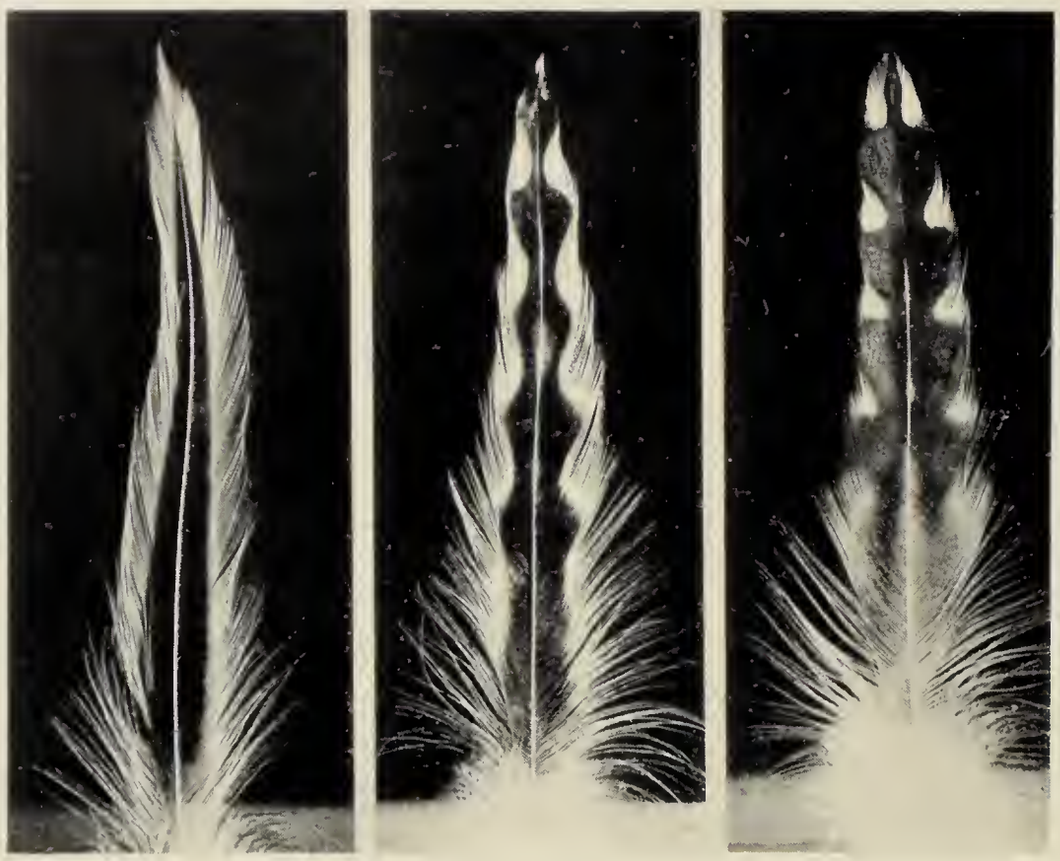
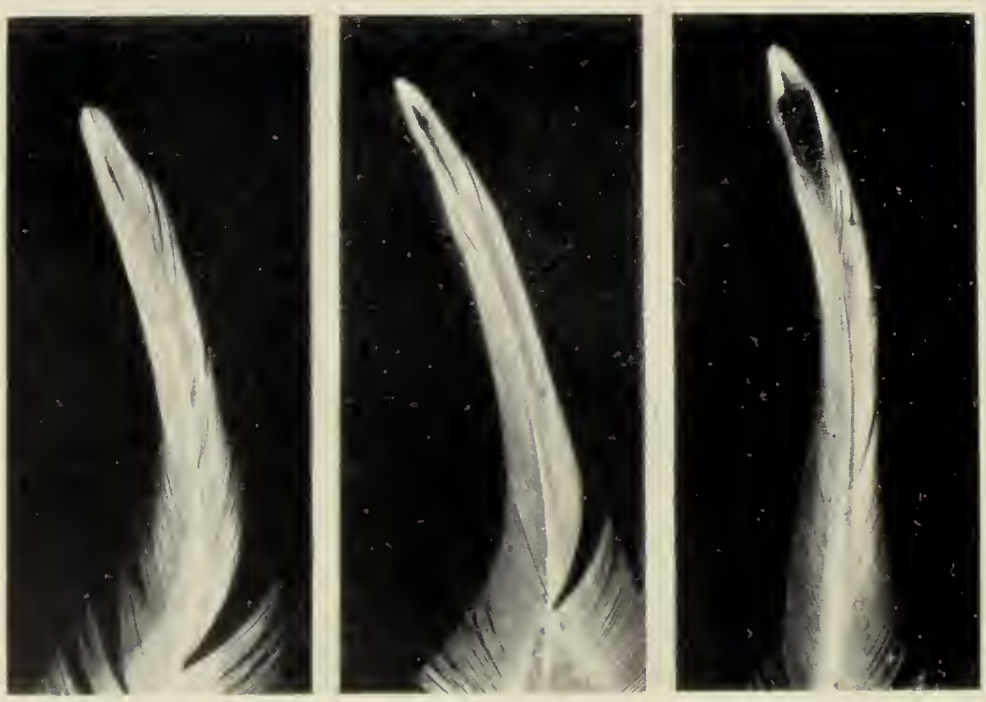


Fig. 39. (Left). Neck hackle feather of male Brown Leghorn; normal control. From Lillie and Juhn, 1932.

Fig. 40. (Center). A neck hackle feather from a male Brown Leghorn that had received 1 mg. of thyroxin by subcutaneous injection every seventh day during the growth of this feather. From Lillie and Juhn, 1932.

Fig. 41. (Right). Same type of feather as in Fig. 40 from a bird receiving 1.5 mg. of thyroxin every sixth day during the growth of this feather. From Lillie and Juhn, 1932.



Figs. 42-43-44. Tips of saddle feathers from Brown Leghorn males recording increasing single doses of thyroxin. Fig. 42 (left), 0.5 mg. Fig. 43 (center), 1 mg. Fig. 44 (left), 1.5 mg. (See also Figs. 45 and 46). From Lillie and Juhn, 1932.

Figs. 45-46. Tips of saddle feathers from Brown Leghorn males recording increasing single doses of thyroxin (continuation of figures 42-44). Fig. 45 (left), 5 mg. Fig. 46 (right), 10 mg. From Lillie and Juhn, 1932.

Figs. 47-48. Left group. The formation of female bars on a male background by injection of female hormone on three successive days during growth (500 rat units injected each day). Fig. 47 (left) from right anterior breast. Fig. 48 from left anterior breast. From Lillie and Juhn, 1932.

Figs. 49-50. Right group. The formation of male bars on a female background by omitting every seventh day of an otherwise daily injection of female hormone during the entire growth of the vane (60 rat units daily for twenty-seven days). From Juhn and Gustavson, 1930.

In the case of the feathers of the saddle, back, and neck, the patterns produced by single or repeated doses of female hormone bring out the same principle of a gradient of thresholds along the axis of each barb in a manner similar to thyroxin (see figures in Juhn, Faulkner, and Gustavson, 1931). There is no need, therefore, to give any details of these experiments.

The special properties of the breast feathers bring out certain consequences more clearly. Only one change is concerned, viz., in the color, from the black of the male to the salmon-colored, or orange, of the female. Breast feathers in general have the highest threshold for female hormone of all contour feathers; and in the breast itself the posterior feathers have a higher threshold than the anterior feathers. The bases of the barbs in any given feather have a relatively low threshold, and the threshold of reaction rises towards the apex. Increasing concentrations of hormone record marks extending from the rhachis towards the margin of the vane.

However, another factor enters into the realization of the female marking produced. This is the *principle of reaction rate.* The margin of the vane (apical sections of barbs) has a much more rapid reaction rate than the axial part. This operates in two ways: first by reducing the period of time (latent period) after attainment of threshold-concentration in the blood before onset of reaction, and second by increasing quantity of reaction occurring in a given time. Thus, female reaction may occur within 24 hours after a sufficient dose, in the margin, whereas from 48 to 72 hours are required in intermediate and axial portions of the vane with any dosage above threshold requirements. The consequence of difference of latent period is that a single dose may record a mark at the margin of the vane alone if it is heavy enough, and if it can be excreted before 48 to 72 hours after injection, a time which covers the latent periods of the remainder of the vane.

The principal of reaction rate is of equal importance with the principle of gradient of threshold in determining the form of a physiologically induced pattern.

By virtue of the two principles of threshold and rate of reaction, transverse bars of female color may be produced in breast feathers by suitable injections of female hormone for two or three days, because the margin of the feather, although having a more rapid rate, records the effect for a shorter period of time owing to its higher threshold than the axial part. Differences in rate and threshold may thus balance one another, producing equal effects all the way across the vane (Figures 47 and 48).

Female bars may thus be produced on a male background by injections for short periods of time; or male bars may be produced on a female background by running a continuous series of injections during the entire growth of the feather, except for stated interruptions, during which the hormone is excreted to below the threshold of the female reaction (Figures 49 and 50).

The patterns that we have hitherto considered are transverse to the axis of the feather in their general arrangement. But it is obvious, according to the same principles, that if one side of the vane of any feathers should have a higher threshold than the other, a correspondingly intermediate dosage of female hormone would affect only the side with the lower threshold, and thus a longitudinally gynandromorph feather would be formed such as have been described by Pézard, Sand, and Caridroit (1926), by Bond (1913), and which has been realized in our own experiments (Lillie and Juhn (1932).

2. Gradients of growth-rate in the development of the feather.

If the same principle of relationship between levels of threshold and rate of growth that we found to obtain between feather tracts should also apply to the individual feather, then we could transpose our experimentally determined gradients of threshold into gradients of growth rate. This was the consideration that induced us to study anew the development of the individual feather (Lillie and Juhn, 1932). For all the details I must refer to the original paper; the conclusions alone can be stated here.

The feather forms form a complete ring of cells established as a thickening of the epidermal layer of the feather papilla at its base, immediately bounding the umbilicus. The original embryonic form of the feather is thus a ring. The rhachis arises by concrescence of the two ring halves, accompanied by continuous growth of the ring, or *collar* as we shall call it; the point of concrescence establishes the dorsal side of the ring, the point opposite being the mid-ventral line. The rhachis is thus composed of two lateral halves fused together. It continues to grow in length so long as the collar maintains its activity. The halves of the collar are continually flowing from the mid-ventral line in opposite directions into the rhachis, the energy for the motion being furnished by very active cell-division and growth. The development of the rhachis is thus from apex to base, as has long been known.

The barbs arise as outgrowths of this ring parallel to one another, perpendicular to the ring, and closely applied to the surface of the pulp. Each arises next to the mid-ventral line, and its attachment to

Fig. 51. Split preparation of a feather germ twelve days after beginning regeneration from the breast of a Brown Leghorn capon. The wall of the conical feather germ was split along the ventral side and spread out flat on a microscope slide after removing the pulp. The rhachis is in the center of the photograph. The youngest barbs are at the margins. The unpigmented base is the collar, bounded by the umbilicus below. From Lillie and Juhn, 1932.

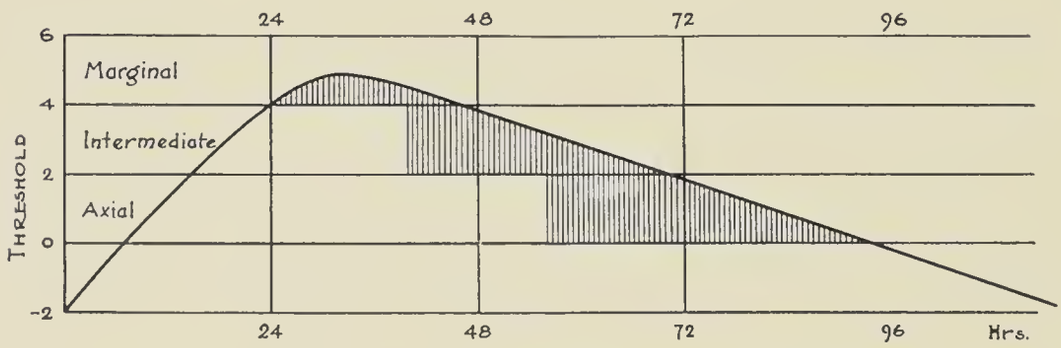


Fig. 52. Half vane; intermittent hormone action. *Curve of intensity.* Effect of female hormone on the breast feather of the Brown Leghorn capon according to a particular dosage. Such a curve of intensity will result in the formation of an even bar from center to margin of the vane (*cf.* Figs. 47-48). Other dosages will produce yet other curves of intensity, resulting in different patterns. The ruled areas indicate duration of reaction—in the present case deposition of pigment of the female type—in the parts of the vane concerned. The ordinates represent the thresholds of reaction of the parts of the vane from axis to margin, and the abscissae represent time in hours. See discussion in text, page 208.

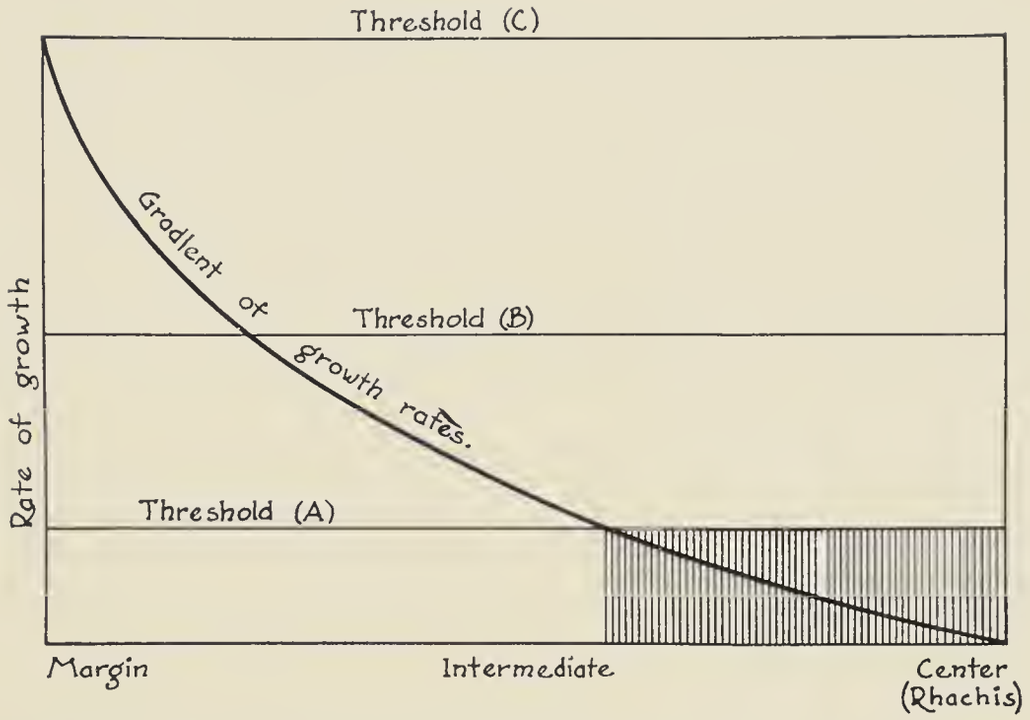


Fig. 53. Half vane: constant hormone action. The hormone action is supposed to maintain a constant level of intensity corresponding to Threshold *A* or Threshold *B*, or Threshold *C*. The reaction is represented for Threshold *A* only, by the ruled area. Rate of growth is plotted as ordinates against position in the vane from margin to center. The intersection of threshold, which is directly proportional to rate of growth, with the curve of gradient of growth rates gives the position in the vane to which the reaction extends from the center (=rhachis).

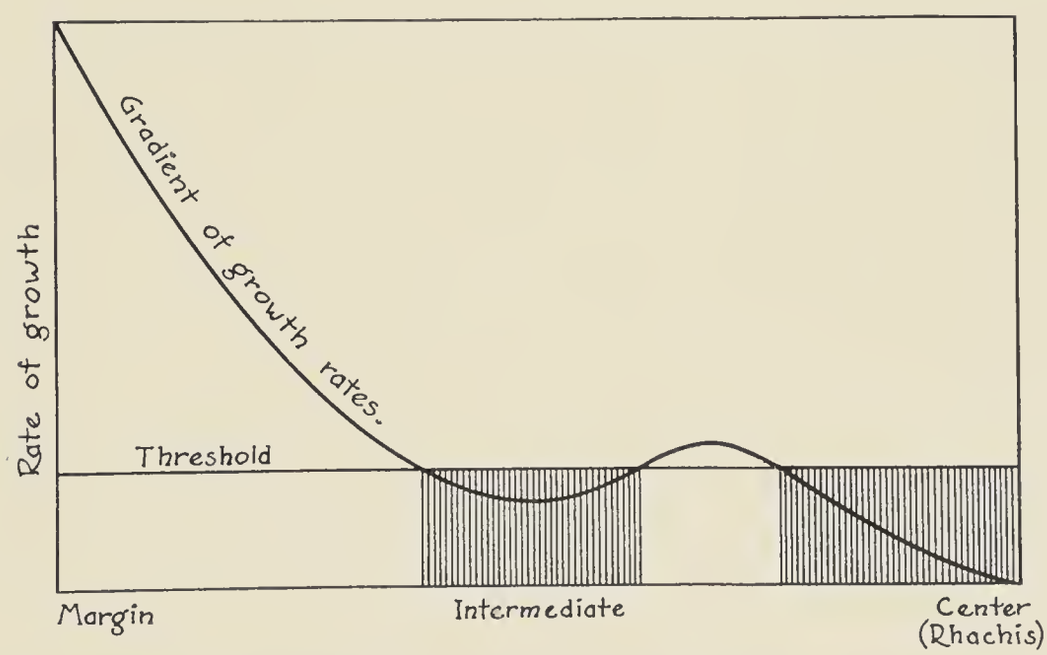


Fig. 54. Half vane: constant hormone action. The curve of growth rates represented here is entirely theoretical, and is postulated to explain longitudinal stripes of intermediate position in the vane. See text, page 210. "Center"=rhachis.

the collar is fixed. As it grows in length it is carried along one side or the other of the two halves of the collar by the flowing movements concerned in the formation of the rhachis until it reaches the point of concrescence on one or the other side of the definitive rhachis, when its growth is fully completed. The time required for transfer from mid-ventral to mid-dorsal line and completion of growth is about ten days in the case of barbs from the middle of the vane of the breast feather. The apical region of the barb is formed first and adjacent regions, to base, in succession; the growth is apico-basal.

There are thus two time-gradients in the feather; from apex to base along the rhachis, and from margin to center along the barbs.

The characters of each barb are finally determined for all the elements that enter into its composition within a very narrow zone adjacent to the collar, *the zone of determination.* It is within this zone that all hormone effects are registered: above it development cannot be altered; below it the cells are still purely embryonic. It will be seen, on reflection (*cf.* Fig. 51), that the zone of determination, from the dorsal to the ventral surface of the feather germ, intersects all barb levels. Thus in any given experiment all levels of barbs are accessible to the hormone.

The growth-rate of the rhachis is approximately uniform, during the formation of the vane at least. This is clearly indicated by the curves in Fig. 38. The slight decrement shown after about thirty days for the feathers of the breast indicates the transition from the vane to the fluffy part of the feather. Certain slight pattern changes along the axis of saddle feathers have suggested, however, that there may be a slight decrement of growth-rate from apex to base not detected by the somewhat rough measurements. The outstanding fact, however, is the approximate uniformity of growth-rate along the axis of the feather.

The rate of growth of the barbs, on the other hand, decreases very greatly from apex to base along a well-defined gradient of growth (*cf.* Fig. 53). The determination of this principle was based upon the possibility of establishing a base line just above the collar throughout its entire extent by suitable hormone injections (Lillie and Juhn, 1932), which make a colored band. In the course of the subsequent growth this base line is moved unequally upward along the axis of feather germ. The inequality of movement registers the unequal rates of growth of successive levels of the barbs, which can be represented in a curve of rate of growth, as in Fig. 53.

The form of the curve has been estimated as accurately as possible from the data at our disposal for the breast feather. It is not, however, to be regarded as mathematically exact. The indication conveyed by the curve that the lateral half of the vane may be divided roughly into three longitudinal zones—an axial zone with slowest growth rate, an intermediate with slightly higher growth rate, and a marginal with greatly increased growth-rate—is of significance. In the case of the saddle feather of the capon there are indications that the form of the curve differs in some details, though the great difference in rate between the margin and the remainder of the vane obtains here also. The indications are that curves of growth-rate of the barbs differ typically between rounded and acuminate contour feathers.

The experiments definitely prove that there is a close agreement between threshold of reaction and growth-rate along the axis of barbs. The various patterns formed by injections of hormones are fully explained as to their form by the gradients of growth-rate. The finer composition of the patterns, however, depends upon other inherited capacities and potencies of the particular feather concerned.

IV. General Discussion

It is reasonable to suppose that the principle of a gradient of growth rates along the axes of the barbs during the development is a general one. It goes far towards explaining the more general features of feather pattern, if we are further allowed to assume that genes operate in the developing feather in manners similar to hormones. A single determining factor, such as a hormone or gene, may produce great variety of results (patterns) depending on curve of intensity and periodic activity.

No pattern is exactly symmetrical; for feathers, like other structures exhibiting bilateral symmetry, always possess an underlying asymmetry, more or less pronounced. There exists every grade of departure from bilateral symmetry in the feathers of fowl down to quite extreme asymmetry. The grade of asymmetry bears certain definite relations to the main axes of the entire body, or the wings, as will be more precisely defined in a paper to be published later. Symmetrical patterns therefore grade into asymmetrical patterns by imperceptible degrees.

It should also be noted that, as the two sides of the vane develop independently of one another, any pattern of the entire vane depends for its symmetry on simultaneous and equal processes in the two halves of the collar. Any disturbance of the processes that affects the two

sides unequally will result in a certain amount of asymmetry. Thus it is probably very seldom that the two halves of a transverse bar fit one another exactly on the rhachis. That such fitting is, however, usually so close is a revelation of precision in the developmental process.

As a symmetrical pattern is thus composed of two equal halves, it is sufficient to consider one side of the vane.

For descriptive purposes patterns may be divided into transverse, longitudinal, and concentric.

1. Transverse patterns.

These are due to *intermittent factors* operating during the development of the feather.

The most complete form of the transverse pattern is the bar. We have already seen how, with intermittent action of hormone, the factors of threshold and rate of reaction may be so equalized as to produce a bar of even width across the vane. This depends, as we have already seen, on a rise and fall of hormone concentration of such a kind that its highest point is above the threshold requirements of all transverse levels, and its beginning and end below all thresholds.

The matter can be presented in diagrammatic form as follows (Fig. 52): The ordinates represent threshold of reaction, and the abscissae time in hours. The rise and fall of hormone action is plotted as a curve derived from the general results of numerous experiments and according to dosage of female hormone described in a previous paper (Lillie and Juhn, 1932). This curve intersects all threshold levels twice—in its ascending and in its descending limb. Reaction begins in the margin, owing to its rapid rate, at about 24 hours; it ceases at about 46 hours, owing to excretion of hormone shown in the descending curve. Reaction does not begin in the intermediate portion of the vane until about 40 hours, owing to its slower rate of growth; it lasts until about 70 hours, when the curve falls below its threshold. In the axial portion of the vane reaction does not begin until about 56 hours owing to a yet slower rate, and it lasts until 90 hours, or more, when the curve falls below its threshold also. Thus, an even bar of reaction is recorded all across the vane, because the decreasing time of action from axis to margin is compensated by increment of growth-rate. The threshold levels are, of course, not sharply divided in three as the exigencies of the diagram demand, but flow into one another as indicated in the curve (Fig. 53).

If the curve of hormone action does not rise to the threshold of the marginal portion of the vane, axial patterns form, of a width dependent on the height of the hormone curve, as in the case of thyroxin patterns, in the saddle and neck feathers (Figs. 40-46). The form varies with the relations between the ascending (absorption) and descending (excretion) limbs of the curve. If the descending limb of a curve exceeding the threshold level of the margin should be very steep, and fall below the axial threshold without intersecting the reaction period of the axial portion of the vane a marginal mark would be made stopping short of the axis. In the case of hormone action this means very rapid excretion. Theoretically, the descending limb might intersect the reaction zone of both marginal and axial portions, missing the intermediate reaction zone entirely. This has been realized in our experiments (Lillie and Juhn, 1932). Theoretically, also, the descending limb might intersect only the beginnings of the marginal, intermediate, and axial zones, leaving three spots in a transverse line across each side of the vane. In all of these cases the patterns are modifications of the bar.

A special form of transverse pattern is confined to the tip of the feather, as in so-called spangled breeds of fowl. Dr. Juhn and the writer have pointed out that the developmental history of the tip of the feather differs slightly from the remainder and have suggested that this may be a basis for tip patterns (Lillie and Juhn, 1932, pp. 135-136, 138-139).

We have dealt with hormones as intermittent factors determining transverse patterns by their operation upon the form of development characteristic of the feather germ. Their operation is restricted by the processes of absorption and excretion, and the time factors involved. In the barred breeds of fowl we have a genetic determining factor. One of my students, Dr. G. Montalenti of the University of Rome, has studied this pattern and found that its development follows the same course as that of bars determined by hormones. The only difference is the greater precision and more rapid control. It is obvious from his study that the gene in question exhibits rhythmic activity according to a curve of intensity, with ascending and descending limbs, and that the even width of the bar is due to a gradient of threshold of reaction combined with reaction rates precisely similar to those determined by us for the Brown Leghorn. This paper will be published shortly.

Inherited patterns of the individual feather may thus depend on the same principles of growth and development as physiologically induced patterns.

2. Longitudinal patterns, unlike transverse patterns, which are due to factors operating intermittently, are dependent on factors acting constantly throughout the development of the feather. If a physiological factor, such as a hormone, be of constant low intensity, it will record a longitudinal stripe next to the rhachis (Fig. 53, Threshold *A*); if it be of slightly greater intensity, but still below the threshold of the margin, it will record a wider stripe leaving an unmodified margin (Fig. 53, Threshold *B*); if its intensity throughout be above the threshold of the margin also, the entire vane will be affected (Fig. 53, Threshold *C*).

Constant factors can thus record a positive (axial) and a negative (marginal) stripe side by side, but cannot record two or more positive stripes, so long as the gradient of growth-rates is a descending curve from margin to rhachis. If, however, the gradient should descend for a short distance, then ascend again, before making its final descent to the margin, a constantly acting factor of proper intensity would record two positive stripes separated by a negative stripe and followed by a marginal negative stripe (Fig. 54). Such a gradient of growth rates is purely imaginary, though it is conceivable that it may be found to exist in feathers of certain patterns. Its interest is in helping to show the range of control of pattern theoretically possible on the principle of relationship between rate of growth and threshold of reaction. In this connection it may further be noticed that with such a gradient of growth rate and a factor acting intermittently, such as the barring factor, at a certain grade of intensity, spots would be produced, arranged in both transverse and longitudinal rows, as in the guinea fowl.

3. Concentric patterns may also be derived theoretically from the principles already laid down. In the case of the thyroxin mark, for instance, the pattern is not simple, but is composed of three effects: the first to appear in point of time is a more or less pronounced blanching of pigment freshly deposited; shortly after, the formation of barbules is stimulated; then the deposition of melanin pigment occurs. Thus, there are three serial effects. When the mark fails to reach the margin, the three zones thus created are concentric. They

occur, as a matter of fact, in Figures 43 to 45; but, as they are not sharply contrasted, it requires careful examination of the actual specimen to see them (*cf.* Lillie and Juhn, 1932). The concentric pattern thus depends for its origin on differences of threshold of the elements composing the mark under conditions of a suitable intensity curve.

The principles that we have stated reveal only a small part of the mechanism that nature uses in the production of certain qualities that we have termed pattern in the constitution of the individual feather; they enable us to understand certain abnormalities such as gynandromorphism whether in the individual feather or in the entire plumage; they may be useful in experimental modification or control of some plumage characteristics; they also have broader biological applications. The experiments show, I think, that the plumage of birds is a wonderful material for experimental analysis, and I hope they may enlist the interest of ornithologists to extend them to other forms. Certainly we have here a very little explored and, in all probability, a very fertile field for experimental research.

REFERENCES

Bond, C. J., 1913. On a Case of Unilateral Development of Secondary Male Characters in a Pheasant. Journ. of Genet. 3, 205.

Domm, L. V., 1927. New Experiments on Ovariotomy and the Problem of Sex Inversion in the Fowl. Journ. Exp. Zool. 48, 31-173.

Juhn, Mary and R. G. Gustavson, 1930. The Production of Female Genital Subsidiary Characters and Plumage Sex Characters by Injection of Human Placental Hormone in Fowls. Journ. Exp. Zool., 56, 31-61.

Juhn, Mary, Gwendoline H. Faulkner, and R. G. Gustavson, 1931. The Correlation of Rates of Growth and Hormone Threshold in the Feathers of Fowls. Journ. Exp. Zool. 58, 69-111.

Juhn, Mary and B. O. Barnes, 1931. The Feather Germ as Indicator for Thyroid Preparations. Am. Journ. of Physiol. 98, 463-466.

Lillie, Frank R., 1931. Bilateral Gynandromorphism and Lateral Hemihypertrophy in Birds. Science, 74, 387-390.

Lillie, Frank R. and Mary Juhn, 1932. The Physiology of Development of Feathers. I. Growth-Rate and Pattern in the Individual Feather. Physiological Zoology, 5, 124-184. 8 plates.

Pézard, A., K. Sand, and F. Caridroit, 1926. La bipartition longitudinale de la plume. Faits nouveaux concernant le gynandromorphisme élémentaire. Comp. rend. Soc. de Biol., Paris, 94, 1074.

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STUDIES ON THE BEHAVIOR OF THE GREAT HORNED OWL

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This paper is written on the basis of observations and experiments made during three years (1929-1932) of wild life study in south-central Wisconsin, in which the Great Horned Owl, *Bubo virginianus*, was given rather special attention. It should be admitted, however, that data on behavior were acquired incidentally, the primary purpose of the work being food habits research.

Let us begin with the nestling owlet. My own data have to do with twenty-nine Wisconsin horned owl nests, twelve of which were visited regularly. Of juveniles from the latter, ten were kept tethered to prolong the food habits studies (see Errington, Paul L., Technique of raptor food habits study. The *Condor*, Vol. XXXIV, March-April, 1932, pp. 75-86) some months past the time when they would have flown. In addition, work was done with six captive juveniles, including four birds hand raised from more or less early stages.

The first two weeks in the young horned owl's life have a singularly profound effect upon its future disposition. Recently hatched owlets accustomed to no source of food other than their human attendants came to recognize them somewhat as they would their own parents, even displaying what appeared a great deal like true affection. On the other hand, an owlet reared by its parents through approximately one-fourth of its growth never did really tame, though it tolerated discreet handling. Two juveniles captured shortly before they could fly remained untamable; the nearest they ever came to a compromise with the enemy was to approach for food when forced by hunger—and then only with the most obvious of misgivings.

Hand reared juveniles fed only dead prey were at the age of several months still very helpless, to all appearances quite devoid of active killing instinct. Upon the release of live English Sparrows into the cage of one such owl, it regarded the sparrows with evident curiosity and eventually made a series of clumsy, futile hops in their direction. Handed a live sparrow, the owl reached out and took it, held it gently in its talons while looking it over, and finally let it slip away, uninjured. The raptor then came to me and started tugging at my finger for something to eat. Ultimately this bird learned to kill and eat sparrows left in the cage overnight, but not until many months old and in full adult plumage could it be taught to kill larger prey. Parallel experiences were had with another Horned Owl and with a Barred Owl similarly raised.

The owlet taken when about a quarter grown was best for experimental purposes. It was neither so tame as to be a spoiled pet nor so wild as to react unnaturally in captivity. It would permit of no familiarities but was not hostile. It was merely "its own owl", and matters progressed smoothly as long as the inviolability of its person was respected.

Sparrows were admitted into the cage of this bird when it had attained adult size; it made catches from the beginning, improving steadily in skill with practice. Live Norway rats were then tried, which the bird killed with ease. A medium-sized Belgian hare was not attacked (May 18, 1930) nor was a guinea pig (June 1). The guinea pig, moreover, by frantic efforts to escape and possibly by its alien strangeness, frightened the owl into flying up and clinging to the wire of the cage top. For days the demoralized raptor would not attack even the rats which it had previously handled with facility. Five days of fasting (June 21 to 26) were required to force this bird into killing its own food again, rats being turned into the cage at intervals during this time. On July 7, it was fed, banded, and freed in a suitable woodlot about a mile south of Madison. It was shot four miles east of the city by a hunter, December 20.

One of the wild grown juveniles struck and killed a fifth-grown cottontail rabbit on its first attempt (May 25, 1930). The owl started at once to tear off pieces from the victim's head and to swallow them. Thus, without past experience, this wild creature did what was to be done, if a trifle crudely, which may be contrasted with the ineptness of pets that couldn't do so well several months later. Rats were taken care of with equal effectiveness and more precision, but the darting guinea pig likewise drove this bird up on the wire (June 1). As in the other case, the guinea pig incident ruined the confidence of this owl as a killer. Thereafter (up to June 17), it too was afraid of the rats which should have given it no alarm. Especially was this true of rats that advanced; rats that retreated stood an infinitely better chance of finding an owl on top of them.

The hand-reared horned owls did not become really wild as long as they were dependent upon man for food—at least for twenty months, which is the longest that I have information on a single individual. They became cross and excitable as they matured, nevertheless, and resented more and more any liberties taken with them. The two tamest of my experimental birds at the age of four months would be likely to draw blood if picked up carelessly, largely I think as an unintentional consequence of increased strength. Subjected to what

they seemingly felt indignities, they pinched and grasped with beak and talons in a rough but not vicious manner; that is, their defense inflicted pain but not injury. The two did not change much after four months save to become more irritable and to lose a little—incredibly little—of their helplessness.

The experimental work gave rise to sundry opinions as to what would happen if the tame owls ever got away. Partial enlightenment was forthcoming in a couple of instances. A juvenile about three months old escaped to fly from tree to tree and to alight on a lawn more than a quarter mile away. There it sat, apparently bewildered. Upon noticing my approach, it came to meet me on foot. The other instance concerned two owls (aged six and nineteen months) kept in a small building which was broken open one night by human marauders. Morning came, and the oldest bird was waiting inside, despite the open door. The youngest was gone. On the third day the young man who was caring for the captives heard the familiar call of a hungry juvenile Horned Owl in a woods near by. As he came within fifty yards or so of the woods, an owl sailed out, flew directly toward him, and lit at his feet to be picked up.

Although horned owls as a rule seemed to show an underlying uniformity of behavior, the temperaments of some birds were noted to differ considerably.

To illustrate: Of the ten tethered juveniles, eight characteristically sought escape by flight at each visit during the gathering of food habits data. One employed a definite sequence of hiding, flight, and offense tactics; first, it would conceal itself by "freezing" at the base of the tree to which tethered; then, it would endeavor to take wing; and, last, it would attack. The tenth rarely sought to hide or fly but would await visitors in plain sight, scowling sourly, and requiring only that human legs be within range of the tether chain before it would arrive in all sincerity, eight talons and beak.

This latter youngster was the only one of the tethered ten that ever learned to adapt itself to my semi-weekly visits. It learned to leave me alone if I left it alone, but at the least hint of overt intent on my part, it would be at me, the embodiment of utter ferocity. This juvenile, the most savage with which I have had dealings, happened to be of the same brood as the most helpless and innocuous pet owl I have known.

Nesting studies brought out temperament differences in adult owls, also. Altogether, I have had sufficient intimate relations with adults from twenty nests to speak positively. Parents from eleven would

keep at a distance, sometimes being visible through the trees 150 to 200 yards off, but usually in a position to see, if unseen themselves. At any rate, this is the impression I gained from hearing faint though eloquent hooting deeper in the woods. Nine sets of parents would "talk" and snap their bills from trees within fifty yards of the nest, these birds being in sight most of the time. Three nests were dangerous to visit alone, on account of the old birds attacking. I have twice been badly lacerated by adults defending their young, to say nothing of the occasions I have saved my skin by dodging or by waving off assaults. The presence of a second person completely discouraged actual attacks.

In general the parents displayed the most solicitude toward their young about the time that the latter were ready to leave the nest. This was the culmination of attachments which appeared quite loose prior to the hatching of the eggs. The old birds, too, would fly off and leave downy owlets just out of the egg without apparent reluctance. As the owlets grew, the parents tended to remain more in the immediate environs in the event of disturbances. Usually one of the birds stayed much closer—presumably the female—though sometimes both would perch in the same tree or even on the same limb. Their nearness was directly proportional to the nearness of the investigator to the young; when he was up in the nest, the old ones not infrequently came to the next tree; as he descended they made off into the woods; if he ascended again, they returned.

As parental attachment reaches its height, the adults will often go to any lengths within their physical powers in behalf of their young, even to the extent of flapping on the ground as if crippled. This I have witnessed three times, twice (on consecutive years and in the same woodlot) by what I believe to be the same owl. A more ridiculous sight than a perfectly functional horned owl simulating a broken wing is difficult to imagine. In all three instances in which I observed the broken wing trick to be employed, the crazed parents had first tried everything else in their repertoire; the rarity of this sort of performance—in my experience, at least—is possibly indicative of instincts now hardly more than residual from early avian phylogeny.

Parental obligations to nestlings seem fulfilled for the most part by protection against interlopers and by making available a certain amount of food. The feeding relations of old to young appear on the whole to be indiscriminate. The owlet that gets fed is the one that wants the food and takes it. If the last owlet to hatch from a

clutch of eggs is able to feed regardless of the competition of its stronger nest-mates, it lives; otherwise it is neglected and dies.

Attempting to gain further insight into horned owl family life, I once placed in a nest containing two large juveniles a tame youngster of corresponding age (April 24, 1930). The old birds apparently accepted the stranger without much ado, for the latter was seen to be completely at home the next visit (April 26). May 4, all three juveniles, now ready to fly, were sitting together, looking over the edge of the nest.

The intensity of parental devotion toward the tethered owls was on the wane by June, and this doubtless applies to the free juveniles, now capable flyers. Adults attending two tethered juveniles successfully kept late into the season of 1931 were slackening in their duties still more by the middle of July, but continued to bring food until release of the young, August 8. There was no doubt, nevertheless, that the food was being brought in diminishing quantities coincident with the "weaning" of the free juveniles, the hungry calling of which could be heard throughout almost any occupied woodlot.

The obvious deduction is that the species will look after its young just about so long in accordance with inherent reproductive mechanics. The length of the feeding period of young by adults does not, then, seem correlated with the variable individual needs of the young as affected by circumstances. The "weaning" of mid-summer culminates the protracted juvenile education, whether, it may be presumed, the young have learned to hunt or not.

One of the best observations I have been able to make on "weaning" had to do not with horned owls but with screech owls. In this case (July 5, 1932; Ruthven, Iowa), three young and an adult were watched for a time between sunset and dark. The family was feeding on some sort of insects, the identity of which could not be made out in the dusk. The young swooped frequently, with more or less success. When followed to successive perches by a mendicant youngster, the old bird took flight again.

From scattered, fragmentary bits of data a reasonable inference can be drawn that the adult owls by indifference and maybe by punishment gradually compel their troublesome progeny to shift for themselves. I am convinced that no normal juvenile horned owl fails to take advantage of family support as long as such is to be had. When deprived, it does what it has to.

Where does the juvenile go, after it takes up a wholly independent existence? Of thirteen horned owl nestlings (birds that had never been tamed, tethered, or experimented with in any way to reduce their prospects for survival) personally banded in 1930 and 1931, three were reported shot within a year or so, all at points thirteen to twenty miles of where banded. Similarly scanty data from banded nestling barred owls bear out the belief that the young of resident large owl species, generally, take up quarters a considerable distance from their natal woodlots. This wandering furnishes an explanation for the numbers of horned owls caught seasonally by pole traps on some game farms and hunting club properties.

Conversely, there is good though not indubitable evidence that the Wisconsin adults studied tended to stay from year to year in the same territory. Unfortunately, I have nothing as definite as banding data on adults upon which to base conclusions. I have merely observed in a few instances distinctive behavior on the part of owls seen in woodlots on consecutive years and also continued partiality for certain nest sites not intrinsically of exceptional attractiveness.

For late summer and early autumn, data on horned owl behavior have been virtually unobtainable until the falling of leaves lessened the cover value of deciduous woods. The owls' choice of daylight hiding places restricted to a comparatively limited number of trees still retaining leaves or those draped with vines or otherwise adequate, their retreats may then be better located. It proved extremely difficult —virtually impossible—to make direct observations on the owls themselves, except by flushing the birds, to confirm the fact that certain places were being used; the main reliance was placed on reading of fresh signs about the roost.

Prior to 1932, it was noted casually that horned owls were apt to station themselves in the fall in the near neighborhood of old stick nests (hawk or crow) which they would appropriate in the spring. During the season of 1931-1932 this was checked up more carefully. In the late fall, 1931, five horned owl territories were discovered in regular use (judged by birds seen and by accumulations of feces and pellets beneath roost trees), of which four proved to be nesting areas. Three other nesting areas, not actually visited in the fall, betrayed by old pellets their early occupancy. Exception: one pair did not move into their nesting territory until January or later, though breeding was not delayed, as incubation had started by February 21, 1932.

None of the twenty-nine 1930-1932 Wisconsin horned owl nests upon which personal data were procured showed evidence of having been built or remodeled to any degree by the strigine occupants. In practically every case the owls' nest-making instincts seemed satisfied by cleaning out the debris from the immediate bottom of the nesting place and by lining the same with variable quantities of breast feathers. Nest sites chosen were: red-tailed hawk nests, thirteen; crow nests, eight; hollow trees, three; unidentified stick nests, two; holes or crevices in rock faces, two; fox-squirrel nest, one. Nests taken over were usually in secluded locations, the prospective occupants requiring mainly privacy and convenience; in other respects the birds displayed very limited judgment in selecting nests, as four were of such flimsy construction that they disintegrated during the storms or from use, to dump eggs or owlets on the ground.

It is true that the precipitation of an owlet from a crumbling nest is not necessarily an event of dire consequence to the species. If the owlet is of fair size, it can lessen the violence of its fall by spreading its part-grown flight feathers; if it is not this far fledged, it may still be sufficiently tough to withstand a comparatively terrific impact. Even young horned owls are put together to stay.

Once on the ground, if the owlet is too small to move with facility, it will stay about where it fell and will come to regard that spot as its proper nest, though it may be situated in the middle of a snow bank. Owlets from two nests, reared on the ground from early in their development, assumed the usual defense attitude upon the approach of a man but up to a certain size or age limit made no attempt to leave, as did those of corresponding advancement finding themselves in unfamiliar surroundings. Fallen owlets large enough to get along well on the ground promptly moved off in almost any direction. These wanderers were usually to be located hiding at the base of trees twenty to two hundred yards from the original nests. Moving or remaining stationary, the owlets are cared for by the old birds; since the adults are both faithful providers and formidable protectors, it may make scant difference in the end whether the young spend their full time in the nest or not.

At any rate, there is little question of the horned owl within its geographic range being a successful species under ordinary wilderness and backwoods conditions and in some settled communities. Essen-

tially a bird of low intelligence, it is equipped with a set of stereotyped behavior patterns, effective nevertheless in enabling it to take care of itself generally, except when confronted by novel emergncies or those racially recent. While the horned owl does learn, it learns with difficulty proportional to the remoteness of the new experience from its regular life routine. It exhibits, too, a ponderous adaptiveness by which it sometimes lives in environments as diverse as the buckbrush patches of treeless plains and the suburbs of cities.

In the face of man's persecution its survival is perhaps attributable as much to its secretiveness as to any single factor aside from accidentally favoring circumstances. To the pole-trap it has no answer, nor to the shooting of its young from its nests, nor to the destruction of its environment. It has but the one refuge—sometimes adequate, sometimes not—from the complex perils arising through man and man's enmity. It simply keeps out of sight.

A study of the food habits of the horned owl re-emphasizes the same mechanistic undercurrent conspicuous elsewhere in the species life history. Its food habits as a species are governed by where it is, by what it has access to (see Errington, Paul L., Food habits of southern Wisconsin raptors, Part I—Owls. The *Condor*, Vol. XXXIV, July-August, 1932, pp. 176-186). One can expect practically any animal within its habitat and of a size within its power to handle to be represented in the diet of the Great Horned Owl; exempt only are species the habits and adaptations of which do not leave them vulnerable. Commonly taken are the more nocturnal animals such as rabbits, flying squirrels, rats, mice, skunks, weasels, shrews, small owls, large insects; and more occasionally diurnal forms handicapped by darkness, i. e., poultry, grouse, flickers, meadowlarks, many small birds, fox-squirrels, chipmunks, etc.

From the examination of some 1900 pellets I feel justified in saying that choice plays a minimum role in the horned owls' routine hunting. The horned owl presumably goes out with the intention of getting something to eat, to take what it encounters first and is able to get. The victim is usually a rabbit, for the apparent reason that rabbits are conspicuous, more or less abundant, and easily obtainable. They are large and satisfying and may serve for several meals. Conceivably, the individual owl may recognize somewhat the superiority of the rabbit as prey and be influenced in its hunting thereby, but

other forms likewise highly available will not be overlooked. The horned owl is not particular when it wants to eat. Even carrion is not unacceptable. I knew a horned owl to feed on a skinned cow carcass when the surrounding woods held plenty of cottontails (March, 1931).

When the captive horned owls had eaten they were satisfied, though extraordinary availability of prey would tempt them to kill more than they needed at the time. Living prey by its movements in proximity to feeding owls diverted the latters' attention from killed food already in possession and so invited attack, which did or did not materialize. The reaction, as observed in experiments with horned owls and English Sparrows, seemed wholly reflexive, in no way suggesting any particular enjoyment of killing on the part of the predators used.

In the wild, killing in excess of immediate needs is indicated by the occurrence now and then of two heads of medium-sized individuals of prey in the same pellet. This does not appear to happen often, however, except during the nesting season when the adults must bring in more food than they themselves require, either for the owlets directly or in anticipation of the hatching of the eggs. The evidence from fall and winter pellets shows that horned owls are prone to eat all or nearly all of a given kill. For example, bones of some prey species so exceptional that they could reasonably belong only to the identical individual may be present in two or more pellets from a certain owl.

Broadly, the horned owl is a simple creature of simple needs. It has physical and psychic qualities of positive, neutral, or negative survival value. Its nocturnal habits and silent approach give it a distinct advantage over many types of prey; these, combined with the might of its talons compensate greatly for its inflexibility of behavior. Where the direct and indirect pressure of man is heavy against the species, its natural endowments may not suffice. But whether it thrives or declines, the species will doubtless continue to respond to the vicissitudes of its existence in much the same manner one may suppose it always has, living if it can, because it can.

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THE SNOWY OWL INVASION OF OHIO IN 1930-1931

BY LAWRENCE E. HICKS

The Snowy Owl (*Nyctea nyctea*) regularly winters far to the south of its breeding range, some birds probably crossing our northern border into the United States every year, though in very small numbers. At more or less regular intervals, the species in its migratory wanderings penetrates far into the northern part of the United States in considerable numbers. Such invasions have occurred in 1876-77, 1882-83, 1889-90, 1892-93, 1896-97, 1901-02, 1905-06, 1917-18, 1926-27, and again recently in 1930-31. Snowy Owls are also known to have entered Ohio in some numbers in 1909-10, 1910-11, 1912-13, and 1921-22.

Huntington (1931) has summarized the theoretical biological, meteorological, and astronomical causes of periodic fluctuations in numbers of a species as presented at the Matamek conference on biological cycles in 1931. Regardless of what these causes may be, there is abundant evidence to show that there are well marked cyclical fluctuations in the abundance of northern mice, lemmings, the arctic ptarmigan, and other animals in the arctic regions which comprise the food supply of the Snowy Owl.

To determine the extent of these periodic southward migrations of the Snowy Owl or to make an approximate estimate of the number of individuals of the species involved, is a gigantic task—one which requires the coöperative efforts of hundreds of field workers in every section of eastern United States and Canada. To make similar observations of the species during the nesting season or throughout the normal winter range would be practically impossible at the present time.

Fortunately, the prey of the Snowy Owl is practically the same as that of the arctic fox. An abundance of the food species is followed by a rapid increase in numbers of both foxes and owls. When the food supply fails, the Snowy Owl apparently migrates southward to areas unaffected by the food shortage while the arctic foxes are quickly reduced in numbers by starvation and trapping in large numbers.

The dates of the Snowy Owl invasions as recorded in ornithological publications synchronize almost perfectly with reported fluctuations in numbers of arctic foxes. A record catch of foxes by Canadian trappers is followed by a definite invasion of Snowy Owls. These paired maximums and invasions occur at intervals of three to five, but usually, four years. Gross (1931) has compared the dates for Snowy Owl invasions with the years of maximum numbers of arctic

foxes as determined by Mr. Charles Elton, of Oxford, England, who tabulated the number of arctic fox pelts sold by trappers at the Fort Chima post of the Hudson Bay Company from 1872 to 1930.

Dr. Gross lists 1909, 1913, and 1921 as years in which arctic foxes reached maximum numbers but with no known definite accompanying Snowy Owl invasion. Many specimens of the species, however, were taken in Ohio during the winter of 1909-1910 and 1912-1913 and at least one specimen during the winter of 1921-1922. Thus, we see that the records for at least forty years indicate a very definite relationship between the maximum number of arctic foxes and the Snowy Owl invasions (and the abundance of animals comprising the food supply of both species).

During the winter of 1930-1931 from the beginning of the Snowy Owl invasion, the writer endeavored to compile as complete a list as possible of all Ohio records. All taxidermists of the state were notified of the work and requested to mail in records. The aid of each of approximately seventy game protectors of the Ohio Division of Conservation was solicited. A large number of records came from this source, as many protectors interviewed fifty or more observers in their county territory concerning the presence of "white owls". During the winter season, the writer personally visited and engaged in other ornithological research in fifty-nine of the eighty-eight counties of the state, interviewing some 320 observers concerning records. In addition numerous notices were published in local and state papers and 195 questionaires were mailed to ornithologists of the state, including all Ohio members of the Wilson Ornithological Club.

The response of these efforts was most encouraging, splendid coöperation on the part of everyone concerned making it possible to tabulate what certainly is one of the most complete numerical counts ever made in an area of state size. More than three-fourths of the records were received from two or more sources and the capture of one bird was actually listed in twelve different reports. The writer wishes to acknowledge his indebtedness to the several hundred coöperators who so willingly furnished information.

The figures tabulated below certainly do represent a rather high percentage of all birds actually observed or captured by man in the state during the invasion. How many more actually crossed our borders but escaped detection, we can only surmise. Because of the economic depression, many hunters could not afford to pay for the mounting of birds shot or trapped. Several taxidermists reported a big decrease in receipts and many birds left for mounting uncalled for.

Certainly a much larger percentage of Snowy Owls captured failed to find their way to taxidermists (the best source of records) than in former years. Also the Snowy Owl invasion of 1926-27 made mounted birds so common that they were no longer valued by sportsmen and rural people as unusual or valuable prizes.

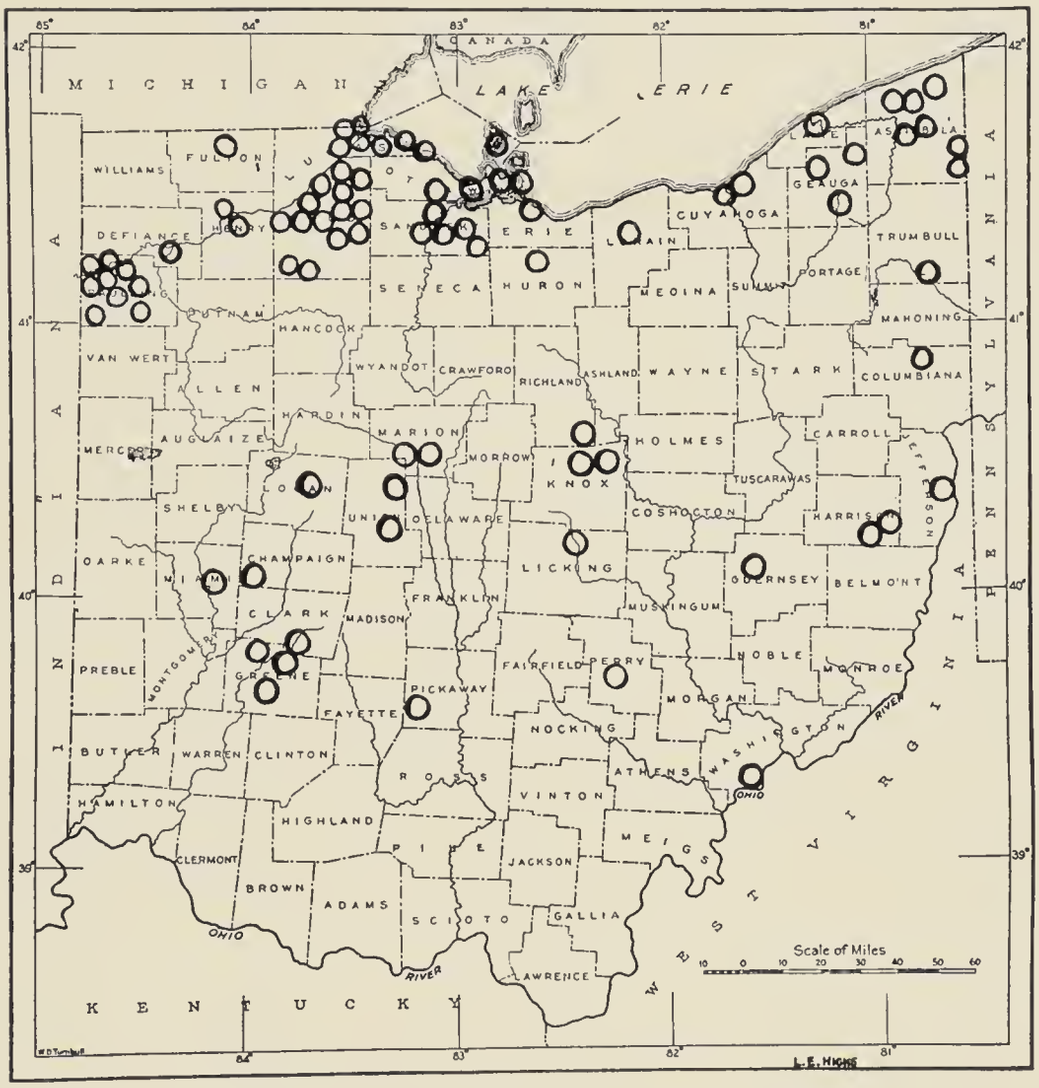

Fig. 55. Snowy Owl Invasion of Ohio in 1930-31.

Gross (1927 and 1931) records 2363 Snowy Owls reported in the United States during the 1926-27 invasion and 1313 birds in southern Canada and the United States in 1930-31. Ohio reported 138 birds in 1926-27 (Thomas, 1928) and 126 in 1930-31. Numbers reported in some other states during the two invasions are as follows: Maine, 589-59; Massachusetts, 294-53; Connecticut, 58-16; New York, 495-63; Michigan, 592-29; and Minnesota, 103-44. Exclusive of Ohio records, and considering only the actual number of birds reported which is

thought to be representative of the total migratory movement, the 1930-31 invasion was only about one-sixth as large as the 1926-27 invasion. This would hardly seem true of Ohio. In 1926-27 the species received wide-spread publicity in the state and the 138 records compiled by Mr. Thomas certainly are fairly representative of the actual numbers present at that time. With nearly as many birds (126) reported in 1930-31, it would seem that this recent invasion must have been at least half as large as the first. Also, the height of the invasion, considering the whole of eastern United States and Canada came near the middle of November in both cases. The height in numbers in Ohio, as determined by Mr. Thomas in 1926-27, took place about December 15, while the height in 1930-31 did not occur before January 10. This very considerable variation in the date of appearance in maximum numbers is indeed interesting. Its significance, though perhaps of importance, is hardly evident at the present time.

Mr. Thomas lists 138 records from 83 localities and 36 counties; the present list includes 126 records from 82 localities and 34 counties. In 1926-27, 92, or 67 per cent, of the birds reported were killed or captured while in the recent invasion only 51, or 40 per cent, suffered the same fate. This, perhaps, is largely due to the fact that the height of the migration came nearly a month later in 1930-31 or mostly following and not during the hunting season. Also, in 1926-27 most of the birds reported appeared to be in a somewhat dazed condition and not at all at home in their new environment. Many were absolutely without fear and others appeared sick. Numerous birds at that time were captured by hand, flying into automobiles or attracted by bright lights. A number were struck down by railroad locomotives, picked up while in an exhausted condition or found in some unusual situation which hardly seemed a logical stopping place for a normal bird of prey. Of eleven stomachs examined by the writer at that time, ten were entirely empty while one contained a small quantity of chicken feathers. Nearly all birds handled were considerably emaciated.

In 1930-31 records of birds taken under unusual conditions were very few. Most birds captured or observed appeared normal in every respect and not dazed or emaciated but as much at home as our native owls. This undoutedly accounts for a much lower percentage of the birds being killed or captured and leads me to believe that in Ohio, and perhaps elsewhere, the 1930-31 invasion did approach that of

1926-27 in numbers much more closely than the figures actually reported would indicate. In 1930-31 a large number of the records listed were of birds reported to have been present in some particular locality for from two to nine weeks, the birds being observed almost daily hunting over stubble fields or bottom lands where meadow mice were abundant. All observers questioned were of the opinion that certainly a large percentage of the birds of this recent invasion did succeed in returning to northern regions in the spring, escaping the tragic fates of most of the owls of 1926-27. Of nine stomachs examined in 1930-31, all but one contained some food, including two Bob-whites, parts of a Ring-necked Pheasant, a sparrow, remains of a Hungarian Partridge, one rat, bits of two chickens, and eight mice.

COMPARISON OF SNOWY OWL INVASIONS IN OHIO

	1926-27	1930-31
Counties of Ohio reporting Snowy Owls	36	34
Number of localities reporting Snowy Owls	83	82
Number of individuals reported	138	126
Number of individuals killed or captured	92	51
Percentage of total number killed or captured	67%	40%
Number of individuals in northern third of Ohio	100	101
Date of earliest record	11-3-26	10-15-30
Height of migration	12-15-26	1-12-31
Date of latest record	5-14-27	5-12-31
Number of individuals reported by months—		
October	0	2
November	25	5
December	49	19
January	6	39
February	11	33
March	5	6
April	1	4
May	1	1

The distribution of records received, as the map shows, was northernly, four-fifths of the returns being from the Lake Erie counties or the counties of northwestern Ohio along the Maumee River, especially Paulding, Defiance, Henry, Lucas, Wood, Ottawa, Sandusky, Erie, and Ashtabula Counties. Few birds penetrated to the southern part of the state but records were much commoner throughout central Ohio than in a belt from twenty to sixty miles south of Lake Erie. On the whole the distribution of records is remarkably similar to that of the 1926-27 invasion.

Bibliography

Anderson, R. M., 1907. Birds of Iowa, p. 266.

Bailey, Bert Heald, 1918. The Raptorial Birds of Iowa, Iowa Geol. Surv. Bull. No. 6, Des Moines, Ia.

Baird, S. F., T. M. Brewer, R. Ridgway, 1905. A History of North American Land Birds, Vol. III. Little, Brown and Co., Boston.

Barrows, Walter Bradford, 1912. Michigan Bird Life, Special Bull. of Dept. of Zool. and Physiology of Mich. Agr. College. Mich. Agri. Coll. Press.

Bendire, Capt. Chas., 1892. Life Histories of North American Birds, p. 389.

Bruner, L., R. H. Wolcott, and M. H. Swenk, 1909. A Preliminary Review of the Birds of Nebraska, p. 56.

Bunker, C. D., 1913. Birds of Kansas, p. 148.

Butler, A. W., 1897. Birds of Indiana.

Chapman, F. M., 1912. Birds of Eastern North America, p. 315.

Cory, C. B., 1909. Birds of Illinois and Wisconsin, p. 497.

Dawson, William Leon, 1903. Birds of Ohio, Wheaton Publishing Co., Columbus, Ohio.

Deane, Ruthven, 1902. Unusual Abundance of the Snowy Owl (*Nyctea nyctea*) in New England and Canada, Auk, Vol. 19, pp. 271-279.

Deane, Ruthven, 1906. Another Large Flight of Snowy Owls, Auk, Vol. 23, pp. 100-101.

Deane, Ruthven, 1907. The Snowy Owl (*Nyctea nyctea*) not Generally Abundant in the Winter of 1906-1907, Auk, Vol. 24, pp. 217-219.

Deane, Ruthven, 1872. Snowy Owl Migrations, Bull. Nutt. Ornith. Club, Vol. 2, p. 9.

Fisher, A. K., 1893. Hawks and Owls of the United States, p. 183.

Forbush, Edward Howe, 1927. Birds of Massachusetts, Part II, Commonwealth of Mass., Norwood Press, Norwood, Mass.

Gross, Alfred O., 1927. The Snowy Owl Migration of 1926-27, Auk, Vol. XLIV, No. 4.

Gross, Alfred O., 1931. Snowy Owl Migration, 1930-1931, Auk, Vol. XLVIII, pp. 501-511.

Goss, N. S., 1891. History of the Birds of Kansas, p. 307.

Hatch, P. L., 1892. Birds of Minnesota, p. 217.

Huntington, Ellsworth, 1931. The Matemck Conference on Biological Cycles, 1931. (Discussion of periodic fluctuations in numbers of a species), Science, Vol. 74, No. 1914. Sept. 4.

Kirkpatrick, John, 1859. Rapacious Birds of Ohio. Ohio Agr. Rept. for 1858, pp. 341-383.

Jones, Lynds, 1903. The Birds of Ohio, p. 108. Ohio Academy of Science, Special Paper No. 6, Oct., 1903, Columbus, Ohio.

Ridgway, R., 1889. Ornithology of Illinois, p. 422.

Ridgway, R., 1914. Birds of North and Middle America. Part VI, Bull, 50. U. S. National Museum, p. 768.

Sutton, George Miksch, 1927. Snowy Owls in Pennsylvania. Cardinal, July.

Sutton, George Miksch, 1928. The Birds of the Pymatuning Swamp and Conneaut Lake, Crawford Co., Pa. Annals of the Carnegie Museum, Pittsburg, Pa., Vol. XVIII, pp. 138-139. (Reprinted separately, Mar. 31, 1928).

Thomas, Edward S., 1928. The Snowy Owl Invasion of Ohio in 1926-1927. Ohio State Museum Bulletin, Vol. I, No. 1, pp. 64-69.

Warren, B. H., 1888. Birds of Pennsylvania, p. 118.

Wheaton, J. M., 1879. Birds of Ohio. Geol. Surv. of Ohio. Vol. IV, pp. 413-414.

Woodruff, F. M., 1907. Birds of the Chicago Area, p. 106.

Ohio Division of Conservation.

Bureau of Scientific Research.

Columbus, Ohio.

THE CORMORANTS OF SOUTH DAKOTA

BY ARTHUR LUNDQUIST

For a number of years Double-crested Cormorants (*Phalacrocorax auritus auritus*) have nested on the islands of Waubay Lake, Day County, South Dakota. Waubay Lake is about five miles northwest of the city of Webster. The islands on Waubay Lake are small. The east island contains about one acre. The west island is only about one-half this size. There are no trees so that the nests of cormorants are built on the rocky points or on the sandy soil.

Besides the cormorants, Ring-billed Gulls, Common Terns, and a few ducks may also be found nesting. The gulls number about two hundred pairs, the terns perhaps somewhat more than this.

The size of the cormorant colony has varied somewhat from year to year. Also the birds have shifted from one island to the other, depending on the depth of water, etc. The drouth of the past few years has undoubtedly forced many birds in other regions to hunt new grounds and many of these may have joined the Waubay Lake colony. In 1931 the colonies on the east and west islands on South Waubay Lake numbered at least seven hundred pairs. This is perhaps the largest colony of this species within the United States.

Young birds may be found in the nest from the middle of May until into September. New nests are built and birds hatched throughout the summer. I am inclined to believe that these late nests are built by birds that have had unsuccessful nesting elsewhere.

I have visited the colonies at least once during the nesting season for the past seven years. During the past three seasons, I have banded a number of the young. The returns show the range of the bird to be about as reported by Lewis.[1] Also one can not make a rule as to time of migration. Birds may be in South Dakota at the last of November or in Louisiana and Texas by October first.

In all I have banded 1175 cormorants. Each year I have tried to make a late visit to the colonies to check the birds which may die on the island. Nesting as closely as they do here a number of birds are killed each year because of crowding. When the birds are old enough to waddle out of the nest, I have found that if frightened the birds will bunch closely and those unfortunate enough to be under the pile die of suffocation. Twenty-six banded birds were found dead in the three years. I believe crowding to be the chief cause of their death.

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[1]Harrison T. Lewis, The Natural History of the Double-Crested Cormorant. Ottawa, Canada, 1929.

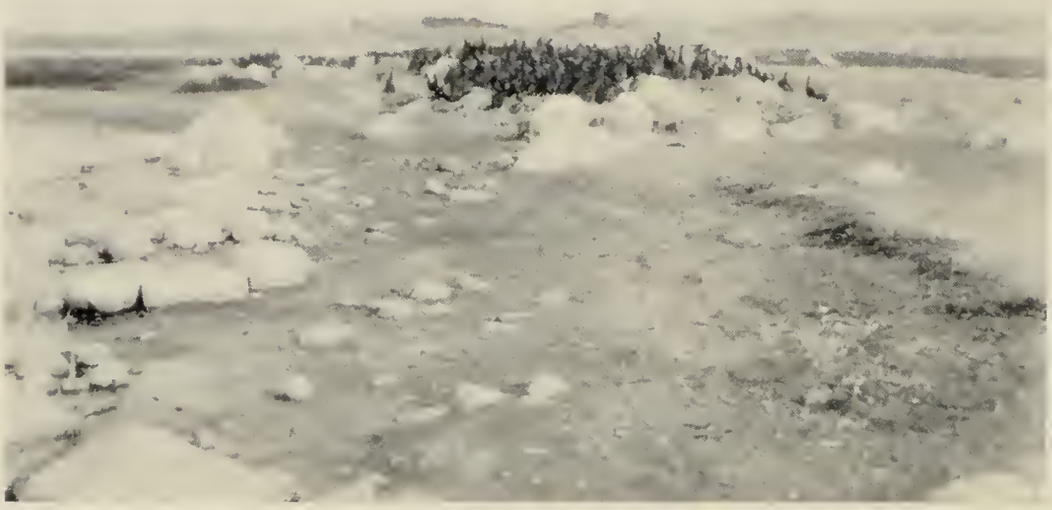

FIG. 56. The Double-crested Cormorant colony on the island in Waubay Lake, S. D. Photograph by the author.

FIG. 57. Closer view of the birds. Photograph by W. F. Kubichek.

Fig. 58. Various views in the Waubay cormorant colony. Photographs by W. F. Kubichek.

The hunter takes the greatest toll of cormorants. During the three years 169 birds have been reported dead by states as follows: South Dakota, 79; Minnesota, 19; Louisiana, 28; Iowa, 8; Nebraska, 3; Missouri, 7; Kansas, 3; Arkansas, 6; Tennessee, 1; Illinois, 3; Texas, 3; Oklahoma, 2; Mississippi, 3; Alabama, 1; Wisconsin, 1; Province of Manitoba, 1; Republic of Cuba, 1. I do not know whether the report from Cuba is unusual or not. I must admit I was somewhat surprised to receive it.

During the summer of 1929, birds were banded in the nest in June, July, and August. Looking over the notes it is apparent at a glance, that the reports of dead birds are much more numerous in the late banding of August birds.

The records show that 314 birds were banded in June. During the fall of 1929 and January of 1930 I find 34 of these reported dead, or 10.8 per cent of the number banded. In July, 61 were banded with 9 or 14.75 per cent dead that fall and winter. In August, 107 were banded with 36 or 33.64 per cent reported dead.

The recoveries from the June group were divided between nine states from South Dakota to Louisiana. The recoveries from the August group were as follows: South Dakota and South Dakota-Minnesota boundary lakes, 30; Arkansas, 2; Nebraska, 2; Oklahoma, 1; Louisiana, 1. Birds in the August group were killed in South Dakota from September 16 until November 28. The chain of lakes in eastern South Dakota is well known for its duck hunting so that there are many hunters in this area.

One may assume that many of the birds which were unable to fly when banded in August were but poor flyers when the hunting season opened on September 16. Also, these birds were not prepared to migrate and therefore were forced to run the gauntlet throughout most of the season in a heavily hunted region.

More than one-third of the August nestlings does seem to me a large number to shoot just for the fun of shooting.

Peabody Hospital,
Webster, South Dakota.

THE WILSON BULLETIN

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EDITORIAL

We Are Happy to Present in this issue a paper by Dr. Frank R. Lillie, the distinguished embryologist of the University of Chicago, and author of one of the best books on avian embryology, "The Development of the Chick". This article penetrates into the problem of the physiological causes of the color pattern of the feather. While the color pattern of the individual feather may be determined by hormones, as Dr. Lillie and his colleagues have shown, one may wonder if these internal factors are sufficient to account for plumage pattern, or whether the latter is due in part to the operation of natural selection, also. It may still be possible that, after the color pattern of the feather has been determined by internal processes, natural selection may play a part in the elimination or survival of the organism possessing it. What external factors may lie behind the variation in quantities of hormones in nature, to bring about the varying color pattern? Or, is there less fluctuation in color pattern than has been supposed, and more orthogenetic evolution, depending directly upon internal factors? Many of our readers are *field* students of birds, but we believe that they will be interested in this glimpse at the experimental aspect of the biology of birds.

The most promising field for research in biology today is in the direction of animal activity, physiology, behavior, etc. Anatomy and classification have had their day—these subjects are not being emphasized in modern biological research. Only here and there are morphological problems of importance found. There may still be some discoveries concerning the relationships of the larger groups: but most of the systematists of today are driven to the work of making subspecies, the biological significance of which is doubtful. And all of these taxonomic problems can be taken care of by a relatively few specially trained men. This is a narrow field for the average man with an interest in ornithology. The young man who looks forward to a professional career in ornithology would do well to consider the field of experimental laboratory work in development; or the field of economic ornithology and game management; or the field of animal be-

havior and psychology, including territory problems. In preparation for these pursuits the student will need all the biological training he can get, including psychology, physiology, ecology, systematic botany, entomology, etc., and chemistry.

Modern studies in animal behavior should be carried out first under natural environment in the field, as far as possible: then results and conclusions should be checked in the laboratory, as far as possible. Field study and laboratory study must go hand in hand in the solution of many modern biological problems; and this will be true in ornithology, as well as in the study of most other special groups. As an example of the way these two methods may be applied we call attention to the study of the Great Horned Owl, by Dr. Paul L. Errington, in this issue. The opportunity for research in the physiology and behavior of birds, as indicated by the papers of Dr. Lillie and Dr. Errington, is unlimited.

Since the preceding lines were written we have received the paper by Baldwin and Kendeigh on "Physiology of Temperature of Birds", reviewed in the pages of this issue of the BULLETIN. Here is another outstanding field of study for the biological ornithologist. The work which is being done at Mr. Baldwin's research station is indicative of a new horizon and a new opportunity. The remedy for the subspecies fad will be found in these new fields of endeavor. Nothing is likely to give better scientific results than a combination of field study with laboratory checks and experiments.

AN EFFORT is being made to locate and list all existing sets of the old *Iowa Ornithologist*, published between 1894 and 1898. Those who possess sets of this early publication will confer a favor by informing Mr. Fred J. Pierce, Editor of *Iowa Bird Life*, Winthrop, Iowa.

GENERAL NOTES

Conducted by M. H. Swenk

The Yellow-throated Vireo in South Dakota.—The writer has found that the Yellow-throated Vireo (*Vireo flavifrons*) is not a rare migrant in South Dakota, but was not convinced that the bird was a summer resident until July, 1932. Early in July, 1931, this vireo was found near Yankton, South Dakota, but I was unable to secure the bird. On July 4, 1932, however, several singing birds were seen and one was collected to dispel any doubt as to the record. This bird was examined and considered to be a breeding bird, and this adds another species to the list of summer residents of southeastern South Dakota.—William Youngworth, *Sioux City, Iowa.*

Nesting of Prairie Warbler Two Years in Identical Location.—During the past few years the Prairie Warbler (*Dendroica discolor*) has become a fairly common summer bird in Upshur County, West Virginia, but it was not until 1930 that a nest was found. One was located in June of that year, near French Creek. The nest was placed in a small apple tree in a brushy pasture, and on June 23 contained three eggs. Rearing was never completed, however, for some prowling animal broke up the nest, and, although the birds were still singing in the neighborhood, we could not find out if they built again.

The birds returned in the summer of 1931, and on the evening of July 2, as we were passing through the same pasture, curiosity prompted us to walk over to the scrub apple tree where the nest had been found the previous year. Much to our surprise, we found another nest, containing three eggs also, and located in almost exactly the same place as that chosen the preceding season.

Bad luck attended this nest also, for it too was broken up before the eggs hatched. We are wondering if the third attempt will be made, or if the spot will be abandoned as definitely unlucky.—Maurice Brooks, *French Creek, W. Va.*

Wilson's Snipe Feeding in Open Water.—On November 17 and 18, 1923, I observed two Wilson's Snipes (*Capella gallinago delicata*) feeding in shallow water in the lake at Englewood Dam, Montgomery County, Ohio. They were well out from the shore, among several small gravelly islands that were devoid of all vegetation. A single Pectoral Sandpiper was their companion on both occasions.

My notes pertaining to the snipes, recorded at the time, read in part: "Frequently they were observed feeding in water up to their bodies. As one crossed from a small island to another about thirty feet away, it to all appearances swam a few yards and then took wing, apparently from water too deep for it to stand in. I observed these birds at about twenty-five yards with 8x glasses as they probed about in the water, and at this distance they were not disturbed at my presence. Nearer approach caused them to fly only a short distance, usually to a sandbar in shallow water. Once one flew to the muddy shore and disappeared in the marginal vegetation."

It was observed that the characteristic "*scaipe*" note was uttered when the birds took wing on being disturbed by my movements, but it was not uttered when the birds flew of their own accord. Often they squatted motionless in the water, apparently a response to the concealment instinct which is so effective when the bird is on land. Although Wilson's Snipe is common here during the migrations this is the only instance I have observed of its feeding sandpiper-fashion in open water.—Benjamin J. Blincoe, *Dayton, Ohio.*

The Orange-crowned Warbler at Ann Arbor, Michigan.—On January 31, 1932, an Orange-crowned Warbler (*Vermivora celata*) came to the feeding shelf at my home and was discovered quietly eating suet in a banding trap. It was apparently a female, for close examination revealed but a slight trace of orange on the crown. The bird seemed to be in good condition and was banded and released. This is the first winter record we have for Michigan.

Barrows (Michigan Bird Life, pp. 587-8, 1912) listed very few records for the state, and considered it more rare than our present knowledge would indicate. Norman A. Wood (Auk, xl, p. 338, 1923) and Walter Koelz (Wilson Bulletin, xxxv, pp. 39-40, 1923, and Auk, xli, pp. 617-18, 1924) have added a few records, but we now have so much additional data that it seems worth while to summarize our knowledge of the species in the Ann Arbor region.

I have listed below only records for Washtenaw County and, except as otherwise specified, all records refer to Ann Arbor. These records are based largely on specimens in the University of Michigan Museum of Zoology and the records of my friend Mr. A. D. Tinker whose field of experience in this region is unequaled.

Spring:

1869. April 24—male collected by M. W. Harrington.
1902. May 14—male collected by N. A. Wood.
1904. May 10—male collected by N. A. Wood.
1905. May 13—female collected by N. A. Wood.
1911. May 1 —one seen by N. A. Wood.
1912. May 5 —one seen by A. D. Tinker and Frank Novy.
May 6 —male collected and two others seen by N. A. Wood at Portage Lake.
1917. May 17—one seen by N. A. Wood.
May 23—two seen and a female collected by Walter Koelz.
1918. May 11—male collected by Dr. Max M. Peet at Delhi .
May 14—one seen at Ann Arbor by A. D. Tinker.
1919. May 3 —one collected by Walter Koelz.
May 4 —two seen by A. D. Tinker; also one on May 13.
1920. May 11 to 13—"abundant at Ann Arbor", Walter Koelz (Wilson Bulletin, xxxv, p. 40).
1921. May 8 —one seen by Walter Koelz.
1922. May 12—one seen by Walter Koelz.
1923. May 13—two seen by A. D. Tinker.
1924. May 3 —one collected by Walter Koelz. "From the 8th to 12th they were most numerous when four or five were seen daily. The last specimen was noted on the 25th," Koelz (Auk, xli, p. 618).
1926. May 2 —one seen by A. D. Tinker; also seen on May 4, 7, 9 (two), and 11.
1928. May 5 —three seen by A. D. Tinker.

Autumn:

1887. October 6—three collected by Dr. A. K. Fisher at Ann Arbor (recorded in a letter of March 10, 1908, to B. H. Swales).
1896. September 10—male collected by Will MacLean.
1906. October 3 —male collected by N. A. Wood at Portage Lake.
1913. October 19—one seen by A. D. Tinker.
1916. September 13—three seen by A. D. Tinker.
1921. September 25—one seen by A. D. Tinker; also one on October 9.
1923. October 14—one seen by A. D. Tinker.
1925. October 4 —three seen by A. D. Tinker. Another seen by him on November 1, although there had been snow and a temperature of 20° on October 29.

The latest autumn record for Michigan is that of a male collected by Walter Koelz (Wilson Bulletin, xxxv, p. 40, 1923) on November 27, 1917, at Waterloo, Michigan (not Ann Arbor as reported in the Auk, xl, p. 338).—Josselyn Van Tyne, *Museum of Zoology, Ann Arbor, Mich.*

A Cardinal's Odd Way of Catching Ants.—This incident concerning the Eastern Cardinal (*Richmondena cardinalis cardinalis*) was related to me by a friend, Mrs. Mary Heath Lee of Fairhope. Mrs. Lee is a very careful observer. She says: "Hearing a pattering on my porch one morning (early in July) I looked out quickly. Cardinals were frequently about but they seldom came nearer than the drinking-bowl in the yard. But there was one (a male) on the porch investigating a dead cockroach. There was really very little of the insect left, but it was surrounded by ants. The Cardinal first picked the ants from the cockroach's body and then from the porch floor. Probably with its broad beak the bird found it difficult to pick up the ants. I was not near enough to see. But it began walking back and forth, dragging its tail alongside, with the underside uppermost, and though this was almost too much for its balance, it managed to stand and pick from the underside of its tail the ants it had thus swept up."—Helen M. Edwards, *Fairhope, Ala.*

The Record of the Starling in Arkansas.—In W. J. Baerg's recent "Birds of Arkansas", published in January, 1931, the record of the European Starling (*Sturnus vulgaris vulgaris*) is given as from Fayetteville, and under date of January 25, 1930. This same source also states that this is the only record for the state. Both of these statements are incorrect. Furthermore the Fayetteville record is based on a rather uncertain sight observation, and could not be accepted in any form except for the work of Mr. S. H. Weakly of Fort Smith, who established the true state record January 18, 1930. On that date Mr. Weakly trapped and banded the first Starling taken in the state, according to all available information. This bird was banded with Biological Survey band No. A239438. Three days later Mr. Weakly banded four of the birds, with bands No. A239474-75, A239495-96, and a sixth bird, No. A350691 on the following day. Since that time and ending February 19, 1930, Mr. Weakly has banded twenty-three more of the birds, for a total of twenty-nine from Fort Smith during the winter of 1929-30.

Of the above Mr. Weakly has received two returns, one No. A239476 (banded January 21, 1930) being found dead by C. E. Dennis, in Moultrie County, Illinois, March 3, 1930, and another No. A350721 (banded February 6, 1930) captured and released by M. Chambers at Athens, Illinois, January 19, 1931.

Mr. Weakly has been kind enough to furnish me with his records to supply the above information, which establishes beyond question the state record. He adds in his letter to me with the above information and records (June 6, 1932) that: "Starlings were fairly plentiful here during the winter of 1928-29, extremely plentiful in 1929-30, very few in 1930-31, and lots of them last winter, but the weather was so mild and feed so abundant that I did not band a single one, although they fed in my garden among my traps."

It is evident from the above that Mr. Weakly had established a sight record for the Starling at least a year before banding a single individual, and that the Starling can no longer be considered as accidental, but as an established winter resident in Arkansas. It might be added that Fort Smith is on the extreme western border of the state, and it is quite probable that the birds are locally even more common at certain places on the eastern side of the state.—J. D. Black, *University of Kansas, Lawrence, Kan.*

American Egret in Lake County, Indiana.—A flock of four Egrets (*Casmerodius alba egretta*) were seen July 29, 1932, two miles west of Merrillville, Lake County, Indiana, by Mr. W. C. Nelson and the writer. These birds, in a small marsh, seemed not at all disturbed by the passing of automobiles on one of the prineipal highways less than 100 yards away.—Philip A. Dumont, *Des Moines, Iowa.*

Some Iowa Birds in a Des Moines Collection.—While recently examining several collections of birds from Central Iowa, a number of specimens were found in the collection of Mr. D. J. Bullock of Des Moines, which are unusual enough from Iowa to warrant publication.

Mr. Bulloek secured these birds prineipally in Story County, Iowa, but specimens are represented from Jasper, Polk, Hamilton, Grundy, Haneoek, and Diekinson Counties, as noted below. The bulk of the speeimens have been taken sinee 1927, but a few (from Jasper County) were colleeted in 1900-01. At the present time the collection has been loaned to the Des Moines Publie Sehools and it is kept in the Washington Irving Junior High Sehool. Mr. Bullock has kindly allowed me permission to publish these reeords.

Horned Grebe (*Colymbus auritus*). One killed in October, 1928, at Eagle Lake, Hancock County. This and the next speeies were seeured at the same time.

Ameriean Eared Grebe (*Colymbus nigricollis californicus*). Four speeimens taken at Eagle Lake, Haneoek County, during Oetober, 1928. Bulloek reported these two species as abundant, but as all of the speeimens are in winter plumage it would be diffieult in the field to determine the number of eaeh that were present.

White Pelican (*Pelecanus erythrorhynchos*). One bird out of a flock of six was killed at Little Wall Lake, Hamilton County, in September, 1929.

Double-erested Cormorant (*Phalacrocorax auritus auritus*). Two specimens from Story County taken in Oetober, 1927. Reported as a fairly eommon fall migrant.

Hutchins's Goose (*Branta canadensis hutchinsi*). A large floek of between fifty and seventy-five was seen in Story County during Oetober, 1927. Of the two specimens secured one is preserved in this collection. This is the smaller of the three forms of Canada Geese visiting Iowa, hardly larger than a drake Mallard.

Lesser Snow Goose (*Chen hyperborea hyperborea*). Two killed out of a flock of seven in Story County, Mareh, 1928. Both are now in this colleetion.

Blue Goose (*Chen caerulescens*). One bird colleeted in Story County during November, 1927.

Hooded Merganser (*Lophodytes cucullatus*). A male taken at Little Wall Lake, Hamilton County, in October, 1929. Bullock states that small flocks are common during fall migration in this loeality.

American Merganser (*Mergus merganser americanus*). A male and female colleeted at Little Wall Lake, Hamilton County, during September, 1929.

Swallow-tailed Kite (*Elanoides forficatus forficatus*). An adult taken in Jasper County during the fall of 1901. This is the only reeord Bullock has of this speeies.

Eastern Goshawk (*Astur atricapillus atricapillus*). One taken in Jasper County during the winter of 1901.

Harlan's Hawk (*Buteo borealis harlani*). There is one specimen taken in Polk County during October, 1930, which shows the typical black streaking on the reddish-black tail.

Rough-legged Hawk (*Buteo lagopus s.-johannis*). There are three specimens from Story County taken in November, 1927. One of these is in the light phase, one in the dark and the third in an intermediate plumage. Another specimen in the dark phase was taken during the winter of 1930-31 in Polk County.

Osprey (*Pandion haliaetus carolinensis*). One taken in Grundy County during the fall of 1927.

Prairie Falcon (*Falco mexicanus*). A specimen of this rare straggler in Iowa was secured by Bullock in Story County during the fall of 1927. The bird is in adult plumage and judging from size should have been a female.

Eastern Ruffed Grouse (*Bonasa umbellus umbellus*). There is a male and female taken in Jasper County in March ,1901.

Greater Prairie Chicken (*Tympanuchus cupido americanus*). Two specimens secured from a flock of fifteen or twenty birds seen in Story County in December, 1927.

Yellow Rail (*Coturnicops noveboracensis*). Two killed in Story County during September, 1928. Bullock says that this species is rather scarce in the marshes near Ames.

Herring Gull (*Larus argentatus smithsonianus*). Two killed out of a flock seen in Story County during March, 1928.

Ring-billed Gull (*Larus delawarensis*). Four specimens taken at Eagle Lake, Hancock County, October, 1928. Bullock states that this gull was present in goodly numbers at that time of year and he has found that it always out-numbers the Herring Gull in Story County.

Franklin's Gull (*Larus pipixcan*). Four collected at Eagle Lake, Hancock County, in October, 1928. All are in winter plumage.

Bonaparte's Gull (*Larus philadelphia*). One in winter plumage collected at Spirit Lake, Dickinson County, October, 1931. Bullock reported them as numerous at that time.

Great Horned Owl (*Bubo virginianus virginianus*). One with two nestlings was taken in Story County during March, 1927. Bullock considers this species fairly common in Polk County. At least twenty were seen during the winter of 1930-31 and one specimen secured.

Montana Horned Owl (*Bubo virginianus occidentalis* Stone). There is one specimen taken in Story County during January, 1927, which must be referred to this subspecies. Bullock states that the bird was killed during a severe spell of cold weather. Inquiry showed that weather north had also been extreme with much snow and ice. The bird was in very poor condition and appeared exhausted.

In this specimen the dark cross bars on the white belly are distinct and uniform, not clouded as in *B. v. occidentalis*. The whitish feathering of the tarsi is without barring, and the facial disk is of a uniform grayish without tawny markings.

The range for this subspecies as given in the A. O. U. Check-List, 4th Edition, 1931, states that it is found in winter south to Nebraska and Wisconsin, not mentioning Iowa.

Snowy Owl (*Nyctea nyctea*). One secured in Jasper County during December, 1900.—Philip A. DuMont, *Iowa City, Iowa.*

New Birds for State College, Pennsylvania.—In 1909, at State College, which is near the geographical center of Pennsylvania, Mr. J. K. Musgrave wrote a thesis on the birds of that region. He listed 146 species of which six have not been recorded there again. They are Red-throated Loon, two collected; Green-winged Teal, one collected; Golden Eagle, two collected; Brunnich's Murre, one collected in the winter of 1894 or 1895 (this specimen is in the oology collection of the Pennsylvania State College); Snowy Owl, one collected in January, 1891; and Blue-winged Warbler.

Since 1909 nearly a dozen people, studying or teaching in the College, have recorded their observations, until today 217 species are listed for the place. Mr. Thomas D. Burleigh, of the Biological Survey, published in numbers of the Wilson Bulletin for June and September, 1924, and March, 1931, a very comprehensive report. Mr. R. C. Harlow has similar articles in the *Auk* of January, April, and July, 1918, but aside from his nesting data the only species not covered by Mr. Burleigh are Saw-whet Owl, Acadian Flycatcher, and Short-billed Marsh Wren.

The following are the species new to State College and vicinity since Mr. Burleigh's report:

Black-crowned Night Heron. One seen May 30, 1930, at Oak Hall (Dr. Haskel B. Curry).

Eastern Least Bittern. Seen September, 1930, at Oak Hall (Curry).

Wood Duck. One female seen in Alan Seeger Forest (Mr. George M. Sutton).

Ring-necked Duck. One seen May 4, 1932 (Dr. Thomas C. Benton).

Canvas-back. One injured female captured alive by a farmer, in November, 1931 (Merrill Wood).

Lesser Scaup Duck. First noted in the fall of 1926 (Mr. J. Warren Large). Seen each spring thereafter.

American Merganser. One seen April 11, 1932 (Benton and Wood).

Rough-legged Hawk. One seen November 10, 1929, over the College farms (Curry).

Ring-necked Pheasant. Introduced in 1925.

Barn Owl. One captured alive on December 10, 1928 (Miss Marjorie R. Ross), and one seen October 4, 1931 (Wood).

Long-eared Owl. One collected in 1925 by a local resident (Wood).

Fish Crow. Seen and heard throughout the year (Wood).

Eastern Mockingbird. One appeared in town November 13, 1929, and remained there until December 14, 1929 (Wood). Said to have been seen once again on January 20, 1930.

Blue-gray Gnatcatcher. One seen spring of 1927 (Large), two seen May 18, 1930 (Curry and Wood), and one seen May 11, 1931 (Curry and Wood).

Northern Shrike. One seen on March 27, 1926 (Large), and one seen November 23, 1930 (Curry).

White-eyed Vireo. One seen in the spring of 1927 (Large).

Philadelphia Vireo. One seen on September 21, 1930 (Curry).

Western Palm Warbler. One seen May 11, 1931 (Curry and Wood).

Kentucky Warbler. One seen May 8, 1927 (Ross).

Boat-tailed Grackle. Seen spring of 1927 at Oak Hall (Large).

Eastern Evening Grosbeak. Four seen April 13, 1930 (Wood).

Canadian Pine Grosbeak. Seen May 1, 1926 (Large), nine seen January 25, 1930 (Wood), and six seen March 30, 1930 (Wood).

Eastern Lark Sparrow. One breeding record, including nest, June 27, 1931 (Miss Farida Willey), published in the *Auk* for January, 1932 (Wood).

Lincoln's Sparrow. Seen September 28, 1929 (Curry), and September 21, 1930 (Curry), and two seen October 4, 1931 (Wood).

The following are some records that are perhaps noteworthy:

Baldpate. One seen April 11, 1932, and a pair seen May 14, 1932 (Wood), the first to be seen since 1909.

Old-squaw. One seen April 21, 1932, at Oak Hall (Wood); only one other record.

Eastern Screech Owl. Still all of the gray phase.

Red-bellied Woodpecker. One seen January 24, 1924 (Large); only one other record.

Northern Cliff Swallow. Colony of forty-two nests in use found May 25, 1930, at Pennsylvania Furnace (Wood).

Northern Blue Jay. A flock of sixty-five counted near Shingletown, September 27, 1931 (Wood).—Merrill Wood, *Harrisburg, Pa.*

Brunnich's Murre in Iowa.—Mr. Frank C. Pellett has recently placed in the hands of the writer a specimen of Brunnich's Murre (*Uria lomvia lomvia*), which he secured at Atlantic, Cass County, Iowa, on December 16, 1896, this being the date given on the original label attached to the specimen. A note referring to this specimen was published by J. H. Brown in the *Iowa Ornithologist* (III, No. 1, p. 11, January, 1897); but it was here reported as "probably the Atlantic form, Uria troile, Linn.", and as "captured alive, but thoroughly exhausted, Dec. 20th near Atlantic and died soon after". Dr. R. M. Anderson, in "The Birds of Iowa" (1907), includes this specimen in his account of *Uria lomvia*, though probably by inference rather than examination, since Mr. Pellett has no knowledge that it was examined at this time. The *Auk* for 1897 contains numerous records of this species for the interior of the continent. It is evident that a flock of considerable size must have been blown inland to lose their bearings. A comparison of these dates indicates that December 16 must have been rather early for a point so far inland as Iowa, while December 20 would be quite comparable; however, the difference is slight. To make quite certain of the identification we recently sent the specimen to Mr. Ludlow Griscom, of the Museum of Comparative Zoology, Cambridge; and we are indebted to Mr. Griscom for verifying our belief that the specimen is *lomvia*—"a young Brunnich's Murre of the year", as he states.—T. C. Stephens, *Sioux City, Iowa.*

Another Hybrid Between the Indigo and Lazuli Buntings.—Walter J. Breckenridge of the University Museum, University of Minnesota, has the credit of collecting, in northwestern Minnesota on June 26, 1929, the first male hybrid between the Indigo and Lazuli Buntings (*Passerina cyanea* x *P. amoena*). On June 1, 1932, the writer took a similar hybrid bird, while working in Cherry County, Nebraska, under the direction of Fred M. Dille, of Rapid City, South Dakota. The country bordering the swift Niobrara River in Cherry County is ideal for the summer home of grosbeaks and buntings. The Indigo Bunting is a fairly common bird in this region, and here also we found several Lazuli Buntings settled for the summer. Beautiful Black-headed Grosbeaks, Western Blue Grosbeaks, and Scarlet Tanagers were found not uncommonly, with a single Cardinal adding more color to this highly-colored group of species.

A typical Indigo Bunting song was heard early on the morning of June 1, and, needing another specimen, the writer located the bird with his glasses and at once noted the odd markings of the bird, which was taken, later dissection showing it to be in breeding condition. Both J. M. Linsdale and W. J. Breckenridge, respectively of the University of California and University of Minnesota, have examined the specimen in question, and evidence points to mixed ancestry of the bird, with characters of the two species about equally well marked. A fine description of a hybrid bunting is given in the Occasional Papers Number 3, of the University of Minnesota, Minneapolis, Minnesota, 1930.—William Youngworth, *Sioux City, Iowa.*

The Bohemian Waxwing in Arkansas.—On May 6, 1931, G. A. Winn, a local banker whom I consider to be a very careful observer, reported the presence on his farm of four birds that he had watched eating apple buds that morning, and which answered to the description of the Bohemian Waxwing (*Bombycilla garrula pallidiceps*). I was satisfied in my own mind at the time that the birds were Bohemian Waxwings, but was fortunate enough to establish beyond doubt the truth of this six days later, when on May 12 I watched a flock of ten of these birds at very close range as they greedily ate the blossoms of a flowering dogwood.

Only one other record for this bird has been made in Arkansas—from Fayetteville in either April or May of 1921, according to the recently published "Birds of Arkansas" by W. J. Baerg. No other reference to the presence of the species in the state can be found, although it is probable that many occurrences of the bird in this section of the state have been overlooked because of the similarity to the very common Cedar Waxwing, which sometimes appears here in large numbers, and is a common winter visitor.—J. D. Black, *Winslow, Ark.*

American Egret in Butler County, Pennsylvania.—Late in the afternoon of August 11, 1932, Adam M. Barker saw a "white" heron at the far side of a large water supply reservoir in central Butler County, Pennsylvania. Efforts to get near the bird were fruitless. The writer accompanied him to the lake to August 13, in an effort to establish the identity of the bird.

About an hour before sun-down, a large white bird flew over from the upper end of the lake. We pursued it downstream and had an excellent view of an American Egret (*Casmerodius alba egretta*) feeding in the shallow margin. The pure white plumage, yellow bill, black legs and the usual midsummer absence of the interscapular plumes, observed at seventy-five yards, left no doubt as to the identity of this summer wanderer from its breeding range.

We visited the lake again on August 20, and were rewarded by seeing the bird in flight. It came halfway down the lake, circled over our heads and disappeared at the upper end of the reservoir where the territory is heavily wooded. Later in the day we found it perched on a tree at the water's edge. A Great Blue Heron, northern cousin of the egret, kept it friendly company from its perch on the limb of a nearby tree.—Sidney K. Eastwood, *Pittsburgh, Pa.*

American Egret in Elkhart County, Indiana.—I wish to announce the occurrence of the American Egret (*Casmerodius albus egretta*) in Elkhart County, Indiana. A single bird was observed August 5, 1932, feeding on Christiana Creek, two miles north of Elkhart. It was observed at a range of seventy-five yards, and the black legs and feet were plainly seen. It was last seen on August 15.—Raymond J. Fleetwood, *Elkhart, Ind.*

ORNITHOLOGICAL LITERATURE

THE BIRDS OF MINNESOTA. By Thomas S. Roberts, M. D. Two volumes. The University of Minnesota Press, Minneapolis, 1932. Pp. i-xxiii+1-691, i-xv+1-821. Ninety-two color plates, 606 text illustrations, five maps. Price, $6.00.

The ornithological students who live in the Mississippi Valley will regard this work with satisfaction and pride, as evidence of the virility and activity of the middle west in this particular branch of natural history. It is a beautiful piece of work mechanically, and a most laudable one textually. While "The Birds of Minnesota" is limited by title to a single state, yet the list of birds and descriptions will fit very closely also the group of states in the upper Mississippi Valley. It is the last word on the ornithology of this region, and is likely to remain such for some time.

Volume One opens with "An Historical and Biographical Review of Ornithology in Minnesota" (pp. 1-18), a subject always of importance to students, and in this case fully and explicitly treated. For our own part we heartily concur in the high estimate given in these pages to the work of Dr. Elliott Coues. The author has been very generous in his acknowledgment of assistance from many sources. In the chapter devoted to geography the author presents an entertaining and instructive account of the topography, vegetation, and climate of the state. Further on are discussed the subjects of life zones, seasonal occurrence, hypothetical species, sight records, game birds and laws pertaining to them, economic value, enemies, parasites and diseases of birds, songs, bird banding, etc., etc. On page 109 the author states that "cats have no legal standing". We had been led to understand otherwise. It is possible that their status varies in different states. We hope that they have no legal status, but would advise our readers to make sure before overtly destroying a trespassing cat that may later be claimed by a neighbor.

The body of the work is a descriptive catalogue of the birds known to have occurred within the state. Most of the specific accounts are presented under the paragraph headings, general range, Minnesota range, migration dates, nests, food, field marks, followed by the author's own copious annotations.

Two hundred and seventy-two pages in Volume Two are devoted to keys and descriptions—a wonderful source of technical information. Fifty-seven pages of bibliography of Minnesota ornithology probably cover the field pretty thoroughly, though the author calls it abridged. The usual index is present.

Volume One contains fifty colored plates, each portraying several species. Volume Two contains forty-two colored plates. Six artists have contributed the plates, viz., Messrs. Allan Brooks, F. L. Jaques, George Miksch Sutton, Louis Agassiz Fuertes, Walter Alois Weber, and W. J. Breckenridge. The last two named are younger artists who are now bidding for honors in this field of work, and we think that they are assured of a position of leadership among bird artists of the time. Mr. Weber's work on the finches and Mr. Breckenridge's work on the sandpipers, just for example, is of a high order in each case. Mr. Jaques' painting of the Great Blue Herons and the cranes is a beautiful thing.

About the only criticism which we feel able to offer is to the effect that the binding seems a little frail for so heavy a volume, and we wonder how long it will hold out with ordinary usage. Such a work as this is usually made possible through philanthropy. And, in this instance a group of Minnesotans, doubtless

friends of Dr. Roberts, made contributions (approximating a total of $30,000, according to a rumor which has reached us) toward the publication of this work. This generosity has made it possible to sell the work at far below cost. We also understand that the edition is rapidly becoming exhausted, which probably accounts for the advertisement of the set at rather high prices in eastern book catalogues.—T. C. S.

The Slaughter of the Yellowstone Park Pelicans. Issued by the Emergency Conservation Committee, New York. September, 1932. Pp. 1-12.

We regret that this pamphlet is issued anonymously, like others recently put out. Though we profess sympathy with some of the aims of the Committee, we believe that signed articles will be more effective and less open to criticism. The present pamphlet exhibits correspondence which, if authentic, shows what has been taking place and who is responsible. What a shame it is that our national parks can be controlled in any way by commercial interests! There can be no doubt that the Yellowstone Park colony of White Pelicans is being "controlled", though we are not prepared to claim that it is being *reduced* below a certain number from year to year. No doubt the colony would increase if allowed to. We visited the Molly Islands in 1927. The men of the U. S. Bureau of Fisheries who were on the ground at that time were very open in their complaint of the pelicans, and gave the writer to understand that means were being found to keep the numbers down. The pamphlet suggests that the colony is "controlled" by destroying the eggs and clubbing the young birds. We believe the Emergency Committee is doing a great public service in bringing these matters to public attention, but we can not approve the practice of anonymity in the publications. —T. C. S.

Physiology of the Temperature of Birds. By S. Prentiss Baldwin and S. Charles Kendeigh. Sci. Publ. Cleveland Mus. Nat. Hist., Vol. III, pp. i-x+ 1-196, pls. I-V, figs. 1-41, and frontispicce. Cleveland, Ohio, 1932.

In this study of the physiology of the temperature of birds an attempt is made to analyze and determine both the external and internal factors in the control of body temperature, there being a constant interplay between those two sets of factors. The authors have devised new and elaborate mechanisms for their purposes. It was found that temperatures could be determined more accurately, as well as more easily, by thermocouples than by mercury thermometers.

There are many interesting facts connected with the physiology of body temperature of birds. As has long been known in the case of mammals, muscular activity is an important factor in body temperature. The authors think that if the body temperature of birds is higher in the summer than in the winter, the fact is to be explained by greater activity rather than by higher air temperature. Their data also lead to the conclusion that the incubation temperature is uniform throughout, that is, there is no increase in the body temperature of the sitting bird during the latter period of incubation.

The daily rhythm of the body temperature of an incubating bird is represented by a typical sigmoid curve, which seems to be an exaggeration of the corresponding air temperature curve, but is also indicative of relative metabolic activity. Moreover, this sigmoid curve of daily temperature may be reversed experimentally. By keeping birds in the dark during the daytime, thus subduing

normal activity, and then transferring them to a well illuminated room at night, a complete reversal of the temperature curve is effected; which, doubtless, also affects the entire metaholic routine. In the authors' repetition of this experiment they found a tendency toward mortality in the subjects, and suggested that "thc reason for their dying may possibly have been a too precipitous reversal of the normal periods of activity". (Pp. 91-92). But if the reasoning here is sound, why should not mammals be similarly affected? And what bearing does all this have upon the night shifts of human labor? Well, who knows? (We note here a typographical error on page 92, line 12, where the figure reference should be 26 instead of 21).

The paper is too long to review thoroughly, but is full of interesting facts, and is another example of the modern trend in biological research, and, we may say, in ornithological research. Here is a great field for the young ornithologist of today.—T. C. S.

Life Histories of North American Gallinaceous Birds, Orders Galliformes and Columbiformes. By Arthur Cleveland Bent. United States National Museum Bulletin 162. Pp. i-ix+1-490. Plates 93.

This is the ninth of the excellent bulletins on the life histories of North American birds published by the United States National Museum, and follows the same general plan as its predecessors except that the present number combines the nomenclature of the 1931 Check-List of the American Ornithologists' Union with the arrangement of families and species as given in thc old (1910) Check-List. Such a combination seems undesirable and likely to produce confusion. Once a nomenclature and arrangement of spccies and families have been adopted by a nationally recognized body such as the A. O. U., all serious papers in the field should make desperate efforts to conform.

A compilation of this kind and size must of necessity deal largely with gencralizations. In this specific case, it is a pleasure to note the many citations of original literature. The stupendous task of collecting together and organizing this mass of notes on life histories has heen accomplished in an unusually satisfactory manner. Any criticisms made herc should not be allowed to detract from our debt to Mr. Bent and the National Museum for these studies. The 160 halftone illustrations do much to make clear the text. All bird lovers should add this volume to their library while it is ohtainable.

When Bent leaves descriptions of behavior and passes to interpretations, he passes into a field whcre his views can not he accepted with such assurance. For instance, on page 149, he speaks of the femalc Ruffed Grouse as "teaching them (the young) to scratch and hunt for insects", and later, he says, "they are taught to dust themselves". It may be questioned that the young are actually taught these things. On the other hand they may be doing these things from instinct. The only way to settle a point of this kind is to raise Ruffed Grouse in an incubator and find out whether young so raised dust themselves and scratch or whether they do not. If, when they are raised in an incubator, they scratch and dust themselves, they certainly do this without being taught by their mother. Similar interpretations scattered throughout the paper are subject to the same type of criticism.—Jesse M. Shaver.

The Distribution of Bird-Life in Guatemala. A Contribution to a Study of the Origin of Central American Bird-Life. By Ludlow Griscom. Bull. Amer. Mus. Nat. Hist., Vol. LXIV, pp. 1-430. New York, 1932.

This excellent study is dedicated to the memory of Jonathan Dwight, Jr., because Dr. Dwight had been deeply interested in the bird life of Central America, and upon whose collections the present report is chiefly based. Without attempting to describe the paper in detail we may say that it deals with the history of the ornithology of the region, with climate, physiography, life zones, and finally, with the distributional list of birds. The work shows all the evidence of being an accurate and authoritative treatise, and will be of great value to all who are concerned with the bird life of Central America.—T. C. S.

The Audubon Yearbook (Indiana) for 1932. Published by the Indiana Audubon Society, Indianapolis, 1932. Pp. 1-100. Price, $1.00 (Miss Margaret R. Knox, Sec.-Treas., 4030 Park Ave., Indianapolis, Ind.).

We have learned to look for interesting material within the covers of this annual, and the present one is no exception to the rule. The volume is dedicated to Dr. Amos William Butler, who might be called the Father of Indiana Ornithology, because he began writing on Indiana birds away back in the '80's, and has never since lost his interest in this pursuit; and, in 1897, he published a complete treatise on the birds of Indiana, which has not been superceded as yet. The portrait of Dr. Butler is presented as a frontispiece, and is followed by a biography prepared by the late Dr. Barton W. Evermann, formerly of Indiana. There is also attached a complete bibliography of Dr. Butler's writings up to date. In connection with a short paper by Mr. O. M. Schantz on the sand dunes there is printed a list of the birds of that region. Because of the popularity of the Indiana dunes this list might well be republished sometime in annotated form. Dr. Earl Brooks continues his ana on the Robin, including such topics as unusual nest sites, various psychological traits, intoxication, bigamy, bathing, number of broods, nest parasitism, albinism, melanism, etc. Dr. Brooks' address is Noblesville, Ind. Mr. George Zebrowski presents a very full and instructive paper on the parasites (internal and external) of birds.—T. C. S.

Biographical Memoir of Robert Ridgway, 1850-1929. By Alexander Wetmore. Biographical Memoirs, Vol. XV, Nat. Acad. Sci, 1932, pp. 55-101. Washington, D. C.

We find here the most important biography of Mr. Ridgway which has thus far appeared, next to the one by Mr. Harry Harris, published in the *Condor* (January, 1928). We did not realize until we checked up at this time, that no memorial sketch has thus far appeared in the *Auk*. A complete bibliography of Mr. Ridgway's work is given; and one may be surprised to find how interesting a personal bibliography can be.—T. C. S.

The Need for Studies in Bird Control in California. By W. L. McAtee. Month. Bull. Calif. Dept. Agric., XXI, April-May-June, 1932, pp. 269-286.

It seems strange that so many birds become pests in California. In the present paper birds classified as pests (under certain circumstances in California) include ducks, coots, quail, band-tailed pigeons, horned larks, blackbirds, goldfinches, English sparrows and linnets, Gambel's sparrows, and possibly one or two others. On page 279 the report states that "a survey of 53 orchards has just been

completed which shows an average loss of 10 per cent for 1930". This is about the same estimate of loss that is claimed from insects. So, economically they would not be any worse off if they killed all the birds and kept the insects. The claims made by fruit growers and others are startling enough; but all such testimony may be assumed to be prejudiced, and perhaps exaggcrated—and it may only be published as a justification for practices. Action should be based wholly upon the reports of the Survey's men, or others without prejudice. The author concludes with an argument for the use of poison as the method of control. Much effort is being made to show that the poison method is selective and discriminative, that the harmful species and individuals only will take the poison. —T. C. S.

Progress Report of the Ruffed Grouse Investigation. By Gardiner Bump, F. C. Edminster, Jr., Robert Darrow, W. C. Ritter, and A. A. Allen. Reprinted from the 21st Annual Report, for 1931, Conservation Dep't, Albany, N. Y., 1932. Pp. 1-19.

Much attention is being given nowadays to the problems of all species of game birds. Many states are supporting scientific investigation on the habits and requirements of certain species especially desired for hunting purposes. One useful table in this paper shows the nature of the food of the Ruffed Grouse month by month throughout the year; percentages are not given, however. From observations at the disposal of the authors it is concluded that grouse abundance fluctuates on a ten-year cycle.—T. C. S.

Ornithology of the Oneida Lake Region: with Reference to the Late Spring and Summer Seasons. By Dayton Stoner. Roosevelt Wild Life Annals, Vol. 2, Nos. 3-4, January, 1932, pp. 267-764, col. pls. 1-2, figs. 117-234.

One is likely to expect this report to deal chiefly with local distribution, but, as a matter of fact, one finds that more attention is paid to the habits of the various species treated; and for this reason the paper will have a general appeal. Two colored plates are by Sawyer, whose skill in placing many small figures on one plate is well known.—T. C. S.

Birds Collected in Cuba and Haiti by the Parish-Smithsonian Expedition of 1930. By Alexander Wetmore. Proc. U. S. Nat. Mus., Vol. 81, Art. 2, pp. 1-40, pls. 1-7. Washington, 1932.

The expedition went by ship among various small islands adjacent to Cuba and Haiti, and the paper is a report on the birds collected, including land birds. An outline map of the territory covered would have been a great convenience to the reader.—T. C. S.

Progress Report of Ohio Upland Game Bird Research. By Lawrence E. Hicks. Reprinted from Trans. 18th Amer. Game Conf., 1931, pp. 1-5.

The matter presented here will be of interest to all who are engaged in game management.—T. C. S.

Bulletin of the Essex County Ornithological Club of Massachusetts. Salem, 1931. Pp. 1-71. Price, 50 cents (S. Gilbert Emilio, Treasurer, 7 Winter St., Salem, Mass.).

The principal paper in this issue of this Bulletin is a revised "List of the Birds of Essex County, Massachusetts", which includes 336 forms, with a supplementary list of twenty-nine forms. This is a splendid way to publish local lists. A dozen other articles of interest are included.—T. C. S.

Research and Education in the National Parks. By Harold C. Bryant and Wallace W. Atwood, Jr. Issued by the National Park Service, Washington, D. C, 1932. Pp. i-vi+1-66.

A splendidly illustrated pamphlet describing the educational work attempted by the Government in the Parks, and giving a history of the development of this work. A useful bibliography is appended.—T. C. S.

A Revised List of the Birds of Ohio. Compiled by Milton B. Trautman. Bull. Bureau Sci. Research, Div. of Conservation, Ohio Dep't of Agric., Vol. I, No. 3, April, 1932, pp. 1-16.

A rather hastily edited, but modernized, list of birds for the state, which will be very useful to all Ohio bird students.—T .C. S.

Policies of the Bureau of Biological Survey Relative to the Control of Injurious Birds. Prepared under direction of Paul G. Redington and W. L. McAtee. Misc. Publ. No. 145, U. S Dept. Agric., Washington, D. C., 1932.

It is stated herein that the general policy of the Survey is "to hold bird-control work to a minimum". There follows a brief discussion of the various kinds of birds which may become injurious. The Biological Survey is often placed in a difficult position between conflicting demands. We hope that its practices will always tally with its declarations of policy.—T. C. S.

Quail Winter Food and Cover. By Paul L. Errington. Reprinted from Amer. Game, three numbers from July to December, 1931.

This reprint combines three instalments as originally published. It is a full official report of the Wisconsin Quail Investigation during the winter of 1930-31. Many interesting facts on the ecology of the Bob-white are here presented. The gist of it all is that these birds must have both food and shelter—the lack of either means disaster.—T. C. S.

Die Vögel Nordostgrönlands zwischen 73° 00′ und 75° 30′ N Br. By Bernt Løppenthin, of Copenhagen. C. A. Reitzel's Press, Copenhagen, 1932. Price, 6 Kroner.

During the summer of 1930 the Danish Godthaab Expedition spent six weeks on the east coast of Greenland. The author of this volume, who was Zoologist for the Expedition, devoted most of his time to the birds, and obtained first-hand information on the birds between 73° 30′ and 74° 20′, North; but with information gained from the inhabitants he was able to report on the range indicated in the title. The volume contains a concise story of the movements of the Expedition a discussion of the forty species of birds found, and an adequate summary of both these parts in English. The text is supplemented with twenty-six text figures and one insert map.—Henry C. Rath.

Avifauna Aegyptiaca. Natatores, Steganopodes, Urinatores. By Alexander Koenig, of Bonn. Journ. f. Ornith., Special Number, 1932. Pp. 1-237.

The present one is the final instalment in a series, the first of which was completed in 1905. The title is slightly at fault, the author suggests, since, with two exceptions, the work deals only with the birds of the Nile Valley. The two exceptions refer to the birds of the Fayum Oasis and those of Sinai. Were it not for these exceptions a more appropriate title, he thinks, would have been, Avifauna Nilotica Aegyptiaca. Only genera and species are described. A total of

257 species, with many additional subspecies, are described in the work; while 38 species are discussed in the present instalment. Because human influence and natural events are producing rapid changes in the environment, the author reminds the reader that the picture which he here presents can be regarded only as a temporary one.—Henry C. Rath.

El Troubadour. The Texas Mockingbird. By R. A. Selle. Houston, Texas (1236 Rutland St.), 1932. Pp. 1-32.

Five delightful essays on the Mockingbird, all short, make this little booklet a prized possession. Anyone will enjoy this eulogy of the chosen bird of the state of Texas.—T. C. S.

Foods of Some Predatory Fur-Bearing Animals in Michigan. By Ned Dearborn. Bull. No. 1, School of Forestry and Conservation, Univ. Mich., Ann Arbor, Mich., 1932. Pp. 1-52, figs. 8, maps 10, charts 22. Price, 25 cents.

This paper, which deals with fur rather than feathers, is the first of a proposed series of bulletins to be issued by the Michigan School of Forestry and Conservation. Special attention has been given to the food of a selected list of mammals; and, of course, birds are found listed in these food charts in many cases.—T. C. S.

The *Migrant* for June contains an article by Mr. A. F. Ganier on the eagles found in Tennessee reprinted from the Journal of the Tennessee Academy of Sciences for April, 1931. Mr. Bruce P. Tyler also tells of a pair of House Wrens which destroyed two nests (with contents) of the Bewick's Wren and drove them away.

The *Chickadee*, organ of the Forbush Bird Club, of Worcester, Mass., continues to reach our desk regularly. It carries much information of general interest, and should be very suggestive to the editors of other local club publications.. The March number gives a list of trees, shrubs, and vines arranged according to the season (summer, autumn, winter, spring) in which their fruits are available as bird food. The July number gives a complete list of ornithological books in the local public library, with the call number for each one. This is a very fine list, but it should contain the *Condor* and Wilson Bulletin. Other numbers are so full of facts and suggestions that enumeration would be quite impossible.

The St. Louis Bird Club issued two numbers (May and June) of a mimeographed periodical, the name of which was to be decided later. The pages serve to record the programs and field studies, and other matters of interest.

Bird banding periodicals. *Bird Banding Notes* is issued by the U. S. Bureau of Biological Survey. Since our last report the numbers for December ,1931, and May, 1932, have been issued. We have received *News from the Bird Banders* for October, 1931, January, April, and July, 1932; and also *Inland Bird Banding News* for March, June, and September, 1932.

The *Raven* has not missed an issue so far this year. This mimeographed Bulletin seems to restrict its space to actual news in the bird world as reported by the various active bird students in the state. The June issue presents an account of a three-day sojourn of a party of four in the Dismal Swamp.

The *Gull* for October reprints from the Game Breeder some interesting discussion on the question of how the Wood Duck's young leave the nest. The gist of it is that the young leave the nest, and are returned to the nest, on the back of the old bird. The author asserts that he has witnessed the performances.

The International Cat Society (501 Fifth Ave., N. Y.) issues from time to time a mimeographed bulletin which gives information on the harm done by these animals and on the work being done to curb the menace. Up to the present time ten bulletins have been issued.

Several numbers of the *Flicker* have arrived since last noticed. The second number for 1932 contains a halftone reproduction of a *very excellent* photograph of a Great Horned Owl at the nest.

For some years Prof. O. A. Stevens, of the North Dakota Agricultural College, has been issuing in mimeographed form *North Dakota Bird Notes.* This periodical has been issued with considerable regularity for a number of years, and contains a great amount of local ornithology.

It has been announced that the *Letter of Information* of the Nebraska Ornithologists' Union is to be discontinued at the end of this year, to be succeeded by a printed 16-page quarterly.

COMMUNICATIONS

Ridgway's Birds of North and Middle America

With regard to an editorial on Mr. Robert Ridgway's great series on the Birds of North and Middle America in the last number of the Wilson Bulletin (Vol. 44, September, 1932, p. 179) there seems to be some misunderstanding as to the circumstances attending the progress of this publication.

At the time of his death Mr. Ridgway was occupied mainly with work on the synonymy and on the diagnoses for the higher groups for volumes 9 and 10 of this work. Neither of these volumes was completed and we estimate that approximately 50 per cent or less of the work had been finished on them. Due to his failing health Mr. Ridgway did not feel that he could come to Washington to carry out the necessary work to complete the accounts of the various species and subspecies, and it was not practical for him to arrange to do this elsewhere. As a matter of fact Mr. Ridgway wished to give up the task some time before his death and continued only at my earnest solicitation, as it was my desire to have as much of his rich store of knowledge preserved on paper as possible.

The work of completion of these two volumes has been undertaken by Dr. Herbert Friedmann, U. S. National Museum, who follows Mr. Ridgway as curator of birds. While it is intended to complete the work as promptly as possible necessarily some time must elapse before the next volume is ready as there is much to be done upon it.

Alexander Wetmore,
U. S. National Museum, Washington, D. C.

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MR. W. M. ROSENE,
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You are earnestly requested to remit at your earliest convenience, thus saving postage to the Club, and much time and effort to the Treasurer. A receipt will be returned only if requested.

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The Club values the continued support of every member, and every resignation is received with regret.

The reports of the officers for 1932 will be published in the March number. They will be of interest to those who wish to follow the affairs of the organization closely. In round numbers the income of the Club was $500 less than last year. We closed the present year (mid-November) with a bank balance of $547.52, about two hundred dollars less than it was a year ago. This safe balance was made possible by a reduction of expenses, chiefly in the size of the BULLETIN, and by the earnest efforts of the President and Secretary. We should endeavor to provide for such a balance, for it insures our solvency to the close of the calendar year and covers the cost of the current issue of the BULLETIN which is in press.

Our members can help the officers wonderfully this year by paying dues as promptly as possible, so that we may have an early knowledge of our resources and make plans accordingly.

In behalf of the officers of the Club the WILSON BULLETIN extends the greetings of the season to all of its readers, and wishes to thank them for their loyal and generous support.

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